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Dugway Skies —U.S. Army photo

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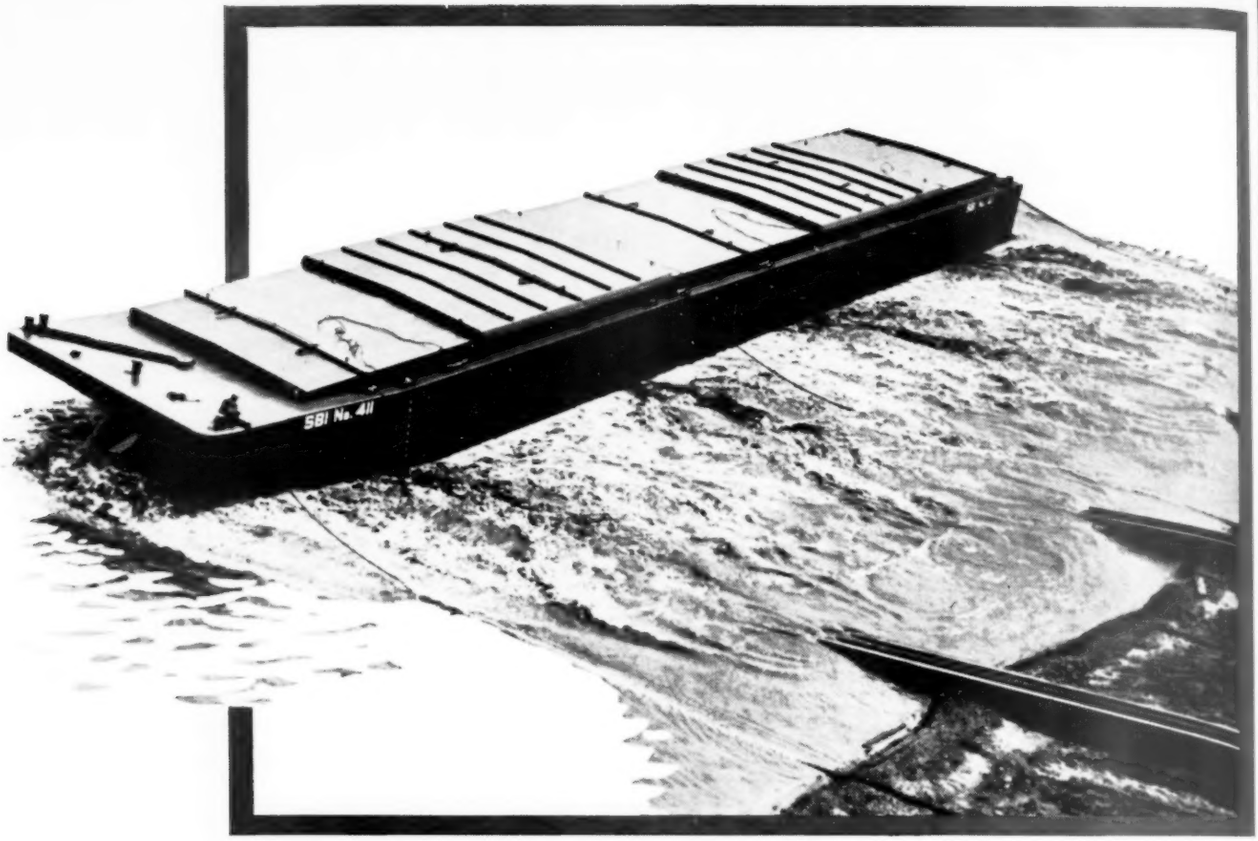

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ARMED FORCES CHEMICAL JOURNAL

OFFICIAL PUBLICATION OF THE ARMED FORCES CHEMICAL ASSOCIATION

SUITES 408-410, 2025 EYE STREET, N.W., WASHINGTON 6, D.C.

VOLUME X | NOVEMBER-DECEMBER 1956 | NO. 6

The fact that an article appears in this magazine does not indicate approval of the views expressed in it by any one other than the author. It is our policy to print articles on subjects of interest in order to stimulate thought and promote discussion; this regardless of the fact that some or all of the opinions advanced may be at variance with those held by the Armed Forces Chemical Association, National Officers, and the Editors. It is the responsibility of contributors, including advertisers, to obtain security clearance, as appropriate, of matter submitted for publication.

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COVER PHOTO

The perimeter of the Dugway Proving Ground sandflat in Utah affords numerous picturesque vistas, such as here shown, which along with frequently magnificent skies give the place a certain charm. See article "Dugway Not All Sand and Sagebrush."

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Published bi-monthly—Jan.-Feb.; Mar.-Apr.; May-June; July-Aug.; Sept.-Oct.; Nov.-Dec.—by the Armed Forces Chemical Association, National Headquarters, located at Suite 819, 2025 Eye St., N.W., Washington 6, D.C. Entered as second class matter at the Post Office at Washington, D.C., under the Act of March 3, 1879. Additional entry at Nashville, Tenn. Subscription price $3.00 per year to members; $6.00 per year to non-members in the United States, Canada and Mexico; elsewhere $1.00 additional for postage. Inquiries concerning circulation and advertising should be addressed to the Secretary-Treasurer.

ARMED FORCES CHEMICAL ASSOCIATION

National Headquarters

408-410 Park Lane Building—2025 Eye Street, N.W.

WASHINGTON 6, D.C.

(Republic 7-6803)

The members of this Association, mindful of the vital importance to national defense of chemistry, allied sciences, and the arts derived from them, have joined together as a patriotic obligation to preserve the knowledge of, and interest in, national defense problems derived from wartime experience; to extend the knowledge of, and interest in, these problems; and to promote cooperative endeavor among its members, the Armed Services, and civilian organizations in applying science to the problems confronting the military services and other defense agencies, particularly, but not exclusively in fields related to chemical warfare. (From Art. II, AFCA Constitution.)

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Vice President W. D. Wilkinson heads Midwest Chapter Task Force for investigation and recommendations of the new Reserve training program.

Task Force at Fort Leonard Wood, Missouri. Left to Right: Lt. Walter L. Clarke, USN, representing Chief of Naval Air Reserve Training Command; Capt. C. I. White, USA, Escort Officer, Fifth Army; Rev. Charles C. Lindsay (with dark glasses); Thomas Sharp; Ray Sobottka; Lewis I. Terry; E. F. Binkerd; Lt. Col. George S. Haviland, USA, commanding Engineer training regiment; W. D. Wilkinson; Lt. Col. Fred K. Vogt, USA, commanding Reserve Forces training regiment.

A.F.C.A. GROUP REPORTS TO DEFENSE OFFICIALS ON THE 1955 RESERVE ACT

WHEN, LAST DECEMBER, the Honorable Charles C. Finucane, then Acting Secretary of the Army, solicited the comment of the Armed Forces Chemical Association on the Reserve Forces Act of 1955 it was thought the matter was one which could be handled by correspondence. A study of the subject soon indicated that more than a casual effort was required.

Under the leadership of Vice-President Wm. D. Wilkinson a group drawn largely from the Midwest Chapter and including the Chapter President, Mr. Evan F. Binkerd, organized what they have called a "Task Force" to undertake a careful study of the Act as it operates and report their findings together with their recommendations for improvement of the operation of the Act.

The Task Force worked diligently on its problem visiting ROTC units, Reserve units, and school groups of pre-induction age. Representatives of this group made a verbal report to Mr. Finucane and members of the Army. At this time they also gained more specific information on the type of information the Army was seeking.

Their work thereafter was more accurately directed. It included acceptance by Mr. Wilkinson of Major General Paul K. McDonald's invitation to visit the 85th Infantry Division at Camp McCoy, Wisconsin. Here the summer training of a reserve division was viewed at close range.

Summer activities of the group included a round of inquiries made to members of all branches of the Service, to industry and commerce to ascertain reactions to the Act. Contact with boys in service and their parents as well as contacts with those eligible to serve broadened the scope of the inquiry.

In August, Lt. General Wm. H. Arnold, commanding the Fifth Army with headquarters in Chicago, invited the Task Force to visit Fort Leonard Wood, Missouri, for two days to view the actual training being conducted under the six months' active training provision of the Reserve Act. This invitation was extended by the Task Force to a representative of Naval Air Reserve Training as it was desired to have his reactions to the Army's program. Mr. Wilkinson's group also invited a member of the City of Chicago School Board for similar reasons. To broaden its inquiry still further, a member of the Task Force, the Reverend Charles Lindsay, specialized in the study of the moral and religious aspects of the Reserve training program.

On September 12, after considerable re-editing, the report of the Task Force was submitted to officials of the Army, Navy and Air Force, the Department of Defense and to the President of the United States.

While no decision on the report has yet been announced, the general reactions to it seem to be most favorable, judging by the enthusiastic informal comment. Called to Washington on invitational orders, Chairman Wilkinson and Vice-Chairman Binkerd met the Secretary of the Army and in an extended discussion reviewed the work and findings of the Task Force. The recommendations of this body were received with apparent interest. Following this conference, these representatives of the Armed Forces Chemical Association conferred with members of the White House Staff and the Secretaries of other branches of the Service. It was indicated that further conferences were desired.

The Task Force planned to make a full report to the Directors of the Armed Forces Chemical Association at their meeting in Washington on October 22, 1956. When released, a complete report will be available for the JOURNAL.

(A.F.C.A. National Headquarters)

TABLET HONORING CML. MTR. BN. WAR DEAD IS UNVEILED

HEADQUARTERS FIRST ARMY, GOVERNORS ISLAND, N.Y.—Soldiers of First Army chemical mortar battalions who died in World War II were honored in a ceremony on Governors Island on October 3, when a bronze commemorative tablet was presented to First Army by the New York chapter of the Armed Forces Chemical Association.

Mr. W. Ward Jackson, president of the New York chapter, made the presentation which was acknowledged by Major General George B. Barth, Deputy First Army Commander. Colonel Thomas H. James, retired, who commanded the 81st Chemical Mortar Battalion in the D-Day landings in Normandy in 1944, unveiled the tablet.

Major General William N. Porter, retired, Chief of the Chemical Corps from 1941 to 1945, was the principal speaker. Brigadier General William R. Currie, Assistant Chief Chemical Officer, represented Major General William M. Creasy, Chief Chemical Officer, at the ceremony. New York's Attorney General, Mr. Jacob K. Javits, a colonel in the Chemical Corps Reserve, and officials from leading chemical manufacturing companies also attended. A parade at Fort Jay garrison followed the dedication.

Former members of the six chemical mortar battalions which were assigned to First Army in World War II were invited. These battalions were the 81st, 86th, 87th, 90th, 92d and 95th.

During World War II chemical mortar battalions were normally attached to front line divisions to provide a close-in support, with their powerful 4.2 mortars. Firing high explosive and white phosphorous shells, these units became a welcome sight to the American soldier on the line. After World War II the 4.2 mortar was made an organic infantry weapon and by 1953 the last mortar battalion had been phased out of the Chemical Corps.

JAMES J. KERRIGAN OF MERCK

James J. Kerrigan, 62, until recently president of Merck & Co., Inc., Rahway, N.J., who began his 49-year career with Merck as a messenger boy in 1907, died on September 5 at Roosevelt Hospital, New York City, after a long illness. He was Chairman of the Executive Committee of the Board of Directors at the time of his death.

Mr. Kerrigan was born in Brooklyn, N.Y. After joining Merck he rose steadily in the Company, becoming a vice-president and a director in 1927. In 1945 he was made commercial vice-president and in 1950 was elected president.

Long interested in education, Mr. Kerrigan was particularly devoted to the American Foundation for Pharmaceutical Education. It was largely through his intervention the U.S. Government took timely steps to stockpile opium which was needed extensively in World War II as a vital ingredient of certain drugs. During the war he served as chairman of the sub-committee on Medicinal Chemicals of the Munition Board.

In 1951 Mr. Kerrigan was honored by the country of his parentage, receiving the honorary degree of LL.D. in Dublin from the National University of Ireland.

GEN. ROTHSCHILD WILL SPEAK AT NEW YORK CHAPTER DINNER

Brigadier General J. H. Rothschild has accepted an invitation to address the annual dinner meeting of New York chapter of the Armed Forces Chemical Association, according to an announcement by Mr. W. Ward Jackson, President of the New York Chapter. The dinner will be held on November 15 at the Hotel Delmonico in New York. General Rothschild, who is Commanding General, Chemical Corps Research and Development Command, will speak on Chemical Corps Research and Development Programs.

Members of A.F.C.A., Active and Reserve Officers of the Chemical Corps, and interested chemical industry representatives are invited to attend. Reservations may be made through Mr. Joel Henry, Chemical Construction Corporation, 525 West 43rd Street, New York, N.Y.

• • •

WILMINGTON DINNER AT DOVER AIR FORCE BASE

Wilmington Chapter with a turn-out of 33 members and guests held its third meeting of the year on September 12 at Dover Air Base, Dover, Delaware. A tour of the Base was followed by dinner at the Officers Mess. Interesting talks on the purposes and activities of the Military Air Transportation Service (MATS) were given by Majors Arthur Allen and Clair Ogle. Mr. A. L. Churchill, chapter president, announced a Nominating Committee consisting of Mr. Harry McCauley, chairman, Dr. Richard Chaddock and Mr. Carl Pratt.

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AUTOMATION DEVICES FOR BACTERIA COUNTS

AUTOMATION MAY soon relieve bacteriologists of one of their more tedious and time consuming tasks according to a recent announcement from the Department of the Army.

Using two approaches to the old problem of finding faster and easier means of counting bacterial colonies, the Army Chemical Corps Laboratories at Fort Detrick, Frederick, Md., have completed basic development and are testing an "Automatic Colony Counter" and an "Automatic Microculture Counter" for defense research purposes.

The Automatic Colony Counter developed for Fort Detrick under contract by the DuMont Laboratories, Clifton, N. J., counts in one second the number of bacterial colonies on a Petri dish.

These Petri dishes contain agar, a gelatin like substance that holds bacteria immobile but does not prevent them from multiplying until clusters or "colonies" of them are visible to the naked eye.

The present practice is to count these colonies by sight. Sometimes, there may be as many as 500 on the three and one-half inch diameter Petri dishes.

To some extent, the announcement states, the Automatic Colony Counter sacrifices the reasoning ability of man for the speed of the machine. For example, man can appreciate that two colonies may join together and overlap, whereas, the machine may count two colonies joined together as one.

IN SPITE OF SUCH possible sources of error, the Automatic Colony Counter appears destined for a place in the laboratory because the bacteriologist, in making bacterial counts, must work with estimates. For instance, he usually assumes that each colony originated from a single bacterium. Since this is not always true, he relies on averages rather than exact counts.

Instead of Petri dishes, the Automatic Microculture Counter utilizes strips made of special type of plastic. These strips are about seven inches long, one inch wide, and one-quarter inch thick. Each is perforated with 994 minute holes, arranged in a rectangular pattern. Each of these holes is, in effect, a miniature test tube. In use, a bacterial culture is prepared in which bacteria are suspended, the number of which is unknown. After the strip is dipped in this bacterial culture, the excess culture drains off the plastic surface, but some of the material is retained in each hole.

Bacteria will be retained in some of the holes, the number depending upon the concentration in the culture.

When incubated, the bacteria retained will multiply until they form a cloudiness visible to the human eye. By counting the number of such "fertile holes" and comparing that number to the number of holes in the strip, the bacteriologist can calculate the concentration of bacteria in the culture.

TO SPEED the counting process, a special camera made under contract with Fort Detrick by Ordnance Engineering Corporation, Frederick, Md., has been developed to photograph the plastic strips. The resulting film is fed into an electronic instrument which counts the number of holes containing bacteria.

The counter activates another instrument that tabulates the results on punched cards which can be fed into an automatic computer. The computer, utilizing the data from a number of plastic strips, can provide a complete statistical analysis in a few minutes.

In practice, it is contemplated that the plastic strips would be photographed in the laboratory and that the film would be processed and analyzed at a central location. A small laboratory, however, could use the plastic strips without the photographic and electronic equipment.

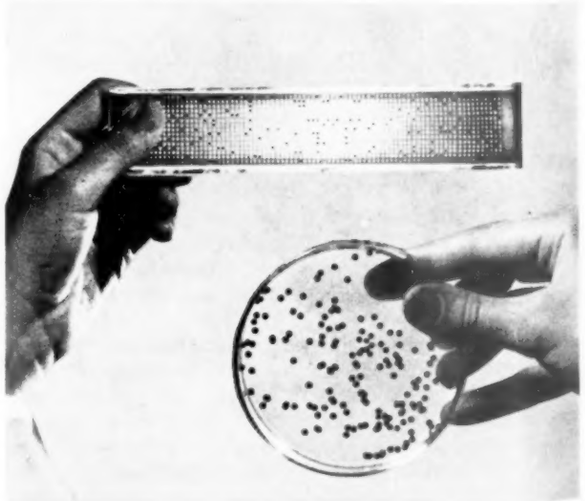
To maintain proper safety precautions, a device has been developed in which dangerous bacteria could be grown in the plastic strips without exposing the technician to the organisms.

Similar safety precautions as well as automatic processing of results are contemplated for the Automatic Colony Counter.

Both the Automatic Colony Counter and the Automatic Microculture Counter are expected to find an area of optimum use.

The Automatic Colony Counter is more adaptable to present laboratory techniques and may also find commercial use in the counting of many small objects.

The Automatic Microculture Counter has not only the potential for speeding bacterial counts, but may also prove useful for counting viruses and rickettsia.



At right in picture above is a Petri dish showing bacteria colonies. In the use of this dish a new electronic counting device obviates the laborious work of counting the colonies individually by sight. Above is shown the newly developed plastic strip for determining bacteria concentrations.

NATIONAL RESOURCES CONFERENCES

This year the Industrial College of the Armed Forces is again promoting in various cities throughout the nation a series of conferences aimed at furthering an understanding of why this "'age of peril' demands the attention of civilian leaders in industry, commerce, education, government," and other fields of social acivity.

In a brochure announcing the conferences for 1956-1957, Major-General R. P. Hollis, Commandant of the Industrial College of the Armed Forces, states in part:

> "Today wars are not fought by armies, navies, or air forces. Wars are fought by nations. Both halves of the civilian-military team must be fully aware of this. Both must understand the tremendous and complex problems inherent in a life or death struggle for survival. Any strategic plan which cannot be supported industrially is doomed to defeat."

The National Resources Conferences program is presented in sixteen (16) cities by a team of Army, Navy, Marine and Air Force officers from the Industrial College faculty. Each conference is a 2-week session, 4 hours a day, 5 days a week. Presentations include 30 illustrated lectures, discussions, movies and usually a trip through a local industrial plant. Each conference is a condensation of the 10-month resident course at the College, which is located in Washington, D.C. Prior preparation is not required of the conferees. However, in each city they are selected, not by the college authorities, but by a local "Civilian Selection Committee." Quotas are limited only by the eligibility criteria and by the size of the auditorium in which the Conference is held. In each city the Conference is sponsored by a civic group, such as the Chamber of Commerce, local university, trade or business association, etc., which is in general charge of the proceedings. Conferees enroll in the Conference locally, not through the Industrial College. While the civilian quota is left to the Selection Committee, the military quotas for each Conference are fixed as follows:

Department of the Army Reserves	50
Department of the Navy Reserves	50
Department of the Air Force Reserves	50
National Guard	6
Coast Guard	2
Local Armed Forces personnel on extended active duty	12
Total	170

The Conference schedule for this fiscal year (including the meetings already held) is as follows:

Birmingham, Ala.	17 Sept.—28 Sept. 56
Denver, Colo.	24 Sept.— 5 Oct. 56
Tucson, Ariz.	22 Oct. — 2 Nov. 56
Butte, Mont.	22 Oct. — 2 Nov. 56
Hartford, Conn.	26 Nov.— 7 Dec. 56
Augusta, Ga.	26 Nov.— 7 Dec. 56
Ventura, Calif.	21 Jan. — 1 Feb. 57
Beaumont, Tex.	21 Jan. — 1 Feb. 57
Jacksonville, Fla.	18 Feb.— 1 Mar. 57
Roanoke, Va.	18 Feb.— 1 Mar. 57
San Antonio, Tex.	18 Mar.—29 Mar. 57
Akron, Ohio	18 Mar.—29 Mar. 57
Hutchinson, Kans.	15 Apr.—26 Apr. 57
Providence, R. I.	15 Apr.—26 Apr. 57
New York, N. Y.	6 May—17 May 57
San Diego, Calif.	13 May—24 May 57

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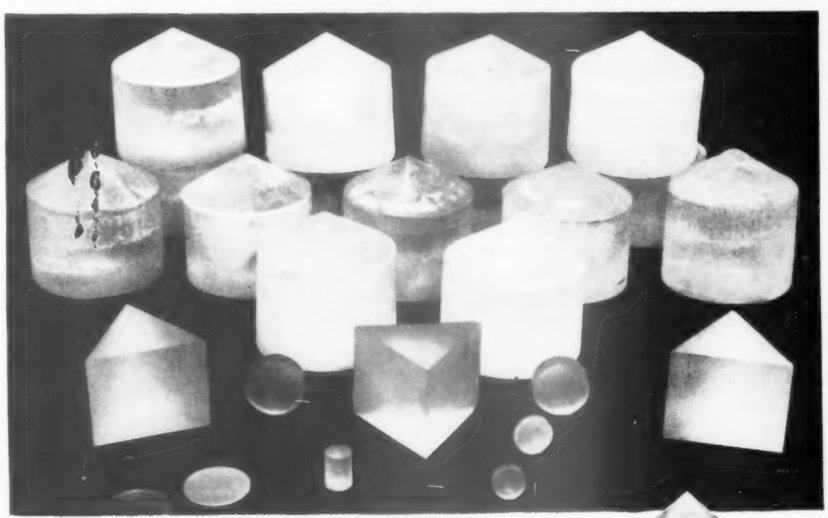

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DUGWAY—
NOT ALL SAND AND SAGE BRUSH

By COLONEL DONALD D. BODÉ
Commanding Officer, Dugway Proving Ground.

(While a good deal has been written and published about the Chemical Corps' Testing Station in the Utah desert, constant improvements and additions to scientific equipment and housing at this establishment make timely this interesting descriptive article by Colonel Bodé.—Ed.)

U.S. Army Photos

IN AN ISOLATED semi-desert area which was once covered by prehistoric Lake Bonneville, some of the most vital test operations in this nation's defense program are being carried on.

Dugway Proving Ground, Utah, the chief testing center of the Army Chemical Corps, uses a giant 952,395-acre tract of land—approximately 1,480 square miles (1.2 times larger than the State of Rhode Island)—which has been established to assure that the United States will have the best possible knowledge of how to defend against a CBR (Chemical, Biological, and Radiological) attack by an enemy.

Located on the fringe of the Great Salt Lake desert, some 80 miles from Salt Lake City, Dugway is in an area that has a rich historical background. For example, the area was once crossed by the Pony Express riders—an old station house is still located on the southern portion of the reservation. Many of the gold-hungry "Forty-niners" trekked over the barren salt flats enroute to California. The first white man to cross the Great Salt Lake desert, Jedediah S. Smith, walked through what would today be the center of the installation. The Overland stage route touched the present post entrance and then skirted around the salt flats. The first transcontinental telegraph lines bordered the southern rim of the reservation. The old Lincoln Highway went directly through the post and even today remnants of it are visible. Now, making history for future generations, there has emerged a cosmopolitan community equipped with the latest in facilities, laboratories, services, apparatus, and technical ideas.

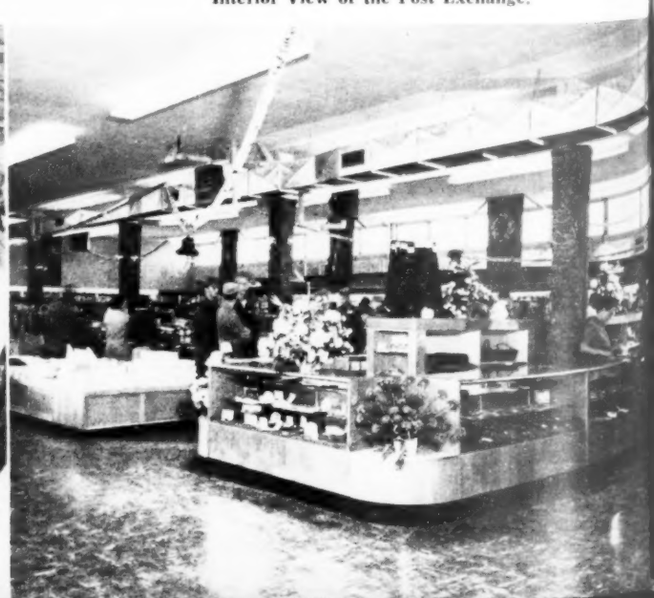
Dugway is a center for technically trained individuals in all categories. Were it not for the presence of military uniforms of all shades, it would remind one of a great campus or university town. The scientists work in buildings and laboratories that are provided with the latest in technical equipment, such as the electron microscope, the infra red and mass spectrometer, X-ray diffusion apparatus, the Univac electronic computer, as well as common and newly designed bacteriological equipment. Too, Dugway technicians have developed items of their own which have proved invaluable in research and technical operations.

RESEARCH IS NOT the sole function of Dugway, however. Briefly, here is the mission of Dugway under the Research and Development Command of the Army Chemical Corps:

1. Responsible for all final engineering tests, final prooftesting of production type items, and operational suitability tests of all end items for which the Chemical Corps has responsibility.
2. Consolidate and collate field test data, and program and conduct tests required to obtain necessary technical data and prepare munition expenditure calculations.
3. Conduct field developmental testing, including safari operations.
4. Initiate and conduct a research and development program to devise and improve field test technology.
5. Responsible for the research program of the Chemical Corps in Cloud Physics.
6. Under broad guidance of the Assistant Chief Chemical Officer for Planning and Doctrine, plan, and conduct such tests and evalutations at Dugway and at off-

Les Brown plays for members of the Officers Open Mess at Dugway.

Interior View of the Post Exchange.



Dugway officer manipulates the "Univac"—the electronic "brain" used in research work conducted here.

View of a portion of the Wherry Housing area.

post test areas as are necessary to provide essential information for the development of BW, CW and RW tactical and strategic doctrine.

7. Program and conduct environment and surveillance testing to obtain data concerning the effect of terrain, climate, and environment on items of interest to the Chemical Corps.

8. Plan and conduct a schedule of BW, CW, and RW field tests as requested by the Air Force, Navy, and other Chemical Corps and Department of the Army agencies.

9. Conduct such research in ecology and epidemiology of wild life as may be essential to the safety of the test sites and their environment.

10. Conduct manufacturing and acceptance tests as requested by the Chemical Corps Engineering Command and the Chemical Corps Materiel Command.

To accomplish this mission, there are 1,203 civilian workers and 1,086 military on post. It may be noted that of the military, over 30% have at least one college degree—an extremely high ratio when compared with Army statistics as a whole. (These figures include the 9771st Technical Unit, composed mainly of Scientific and Professional personnel, and the 2nd Chemical Weapons Battalion—a troop unit whose chief function is to determine the optimum chemical weapons with which a Chemical unit should be armed and to perform operational suitability tests on all Chemical Corps materiel).

To be successful in any work, individuals must be happy and content with their surroundings. Their morale must be high. Since its reestablishment as a Class II installation in July 1950, Dugway has made amazing strides in developing the services and facilities which go to make up a self-sufficing community. There was a time when an assignment to Dugway could be justifiably called an "exile to the desert." No longer is this the case. The installation is now a veritable oasis of brick, cinderblock, and concrete transplanted into acres of sand and sagebrush. Its newness is best suggested by the construction currently completed and now in progress. Its permanence is illustrated by the modern buildings and institutions present.

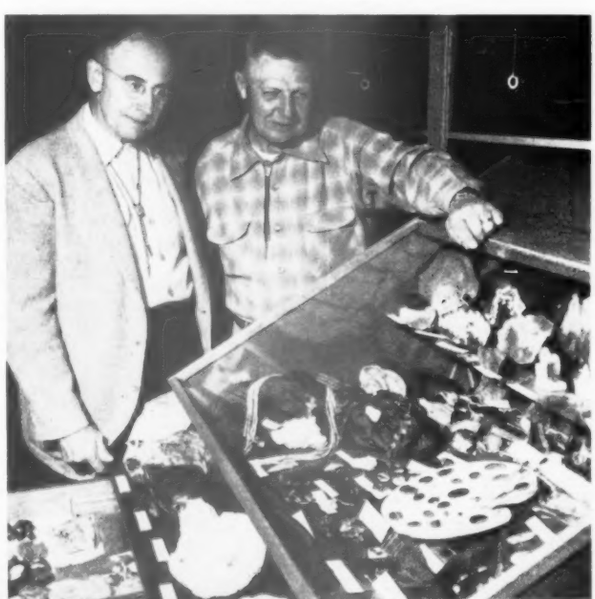
For example, there are 400 Wherry Housing units. These are modern 2 and 3 bedroom bungalows with garages and large yards. Presently under construction are 44 sets of quarters for NCO's and two permanent type homes. The Professional and Scientific Quarters for unmarried personnel are of ultra-modern design with large rooms and beautiful furniture . . . the barracks are an enlisted man's dream.

The school system which functions under the Tooele County Board of the State of Utah is of high caliber. The High School recently received one of the highest merit ratings in the State.

For relaxation and entertainment there are three beautiful and spacious clubs—the officers' Open Mess, NCO Club, and Service Club. A large athletic plant consisting of gymnasium, tennis courts, swimming pool, bowling alley, driving range, with a nine-hole golf course, soon to be built, occupies the spare minutes of those who are athletically minded. The Post Theater affords a welcome form of evening entertainment. However, these facilities are but so much glass, brick and sand without active people to keep them occupied and to devise new ideas of recreation and entertainment. It seems that all Dugwayites subscribe to the belief that "to be busy is to be happy." This is evidenced by the large number of

(Continued on page 40)

A "Rockhound" Exhibit.



2ND CHEMICAL WEAPONS BATTALION HAS BUSY ROLE IN DUGWAY TESTS

U.S. Army Photo

DUGWAY PROVING GROUND, UTAH—On August 15, 1953, the 2nd Chemical Weapons Battalion at the Chemical Corps testing center in Dugway Proving Ground, Utah, formally received from Major General E. F. Bullene, then Chief Chemical Officer, its own colors, and inherited the proud history of its forebears from the original First Gas Regiment of World War I and the 2nd Chemical Mortar Battalion in World War II and Korea.

Since the battalion was formed in January 1953 at Dugway to take the place of the 2nd Chemical Mortar Battalion, it has been extensively reorganized, modernized and adapted to a new function. It has been employed in conducting innumerable experiments and tests so that our Armed Forces may be adequately prepared to defend themselves in the toxicological field. Included in these accomplishments was the provision of valuable information to the Quartermaster Corps from tests of clothing during CBR exercises.

LT. COL. FRANK V. P. WILLIAMS
. . . Commander of 2nd Chemical Weapons Battalion.

The major operational project of the battalion since October 1955 has been Project 4-55, which consisted of field training with 4.5" rocket launchers and their employment in testing operations. On this project and other field operations, the battalion traveled a total of 131,472 miles during the last quarter of 1956 in which they were an integral part of a post exercise with their rocket launchers. Prior to completing the test, the battalion held two ten-day bivouacs in the vast Dugway basin formed by the drying-up of an ancient sea of which only the Great Salt Lake remains.

An unique feature of this exercise was the participation in it of the Marine Corps 3d 4.5" Rocket Battery of Camp Pendleton, Calif., with the battalion. It is believed that this is the first time that such a close integration of the Armed Forces has been accomplished. The 216th Cml Company from Rocky Mountain Arsenal, Colo., also aided in the operation.

4.5" rocket launchers extensively used by the 2nd Chemical Weapons Battalion in their training and test operations in the Dugway Proving Ground, Utah, area.

The 2nd Chemical Weapons Battalion is a direct lineal descendant of the 1st Gas Regiment of World War I, the original Chemical Corps combat unit. The regiment was renamed the 1st Chemical Regiment in the 1920's and was stationed at Edgewood Arsenal, Maryland. In 1935 it was converted to the 2nd Chemical Battalion.

Early in World War II, the 2nd Chemical Battalion was redesignated as the 2nd Chemical Mortar Battalion. It gained much renown through its operations in support of elements of the Fifth and Seventh Armies, in the Sicily, Naples, Rome, Southern France, Rhineland and Central Europe campaigns.

Throughout the Korean conflict, the 2nd Chemical Mortar Battalion operated, providing support not only to many U.S. Army units, but also the 28th British Commonwealth Brigade, The Turkish Armed Forces Command, and various Korean Divisions. The battalion lost over one-third of its personnel as casualties while fighting a rear guard action in defense of the western portion of the line. For outstanding performance of duty and extraordinary heroism in the Korean operations the battalion received the Distinguished Unit citation authorized by the President of the United States in May, 1953.

The battalion is now commanded by Lt. Col. Frank V. P. Williams. He has a B.S. degree in Chemical Engineering from New Mexico A. & M. College and has served in the Army for 24 years.

The thousands of acres in the Dugway Proving Ground test area provide ideal ground for training exercises conducted by the 2nd Chemical Weapons Battalion.

The 2nd Chemical Weapons Battalion personnel lay down a smoke screen during training operations at their station of Dugway Proving Ground, Utah.

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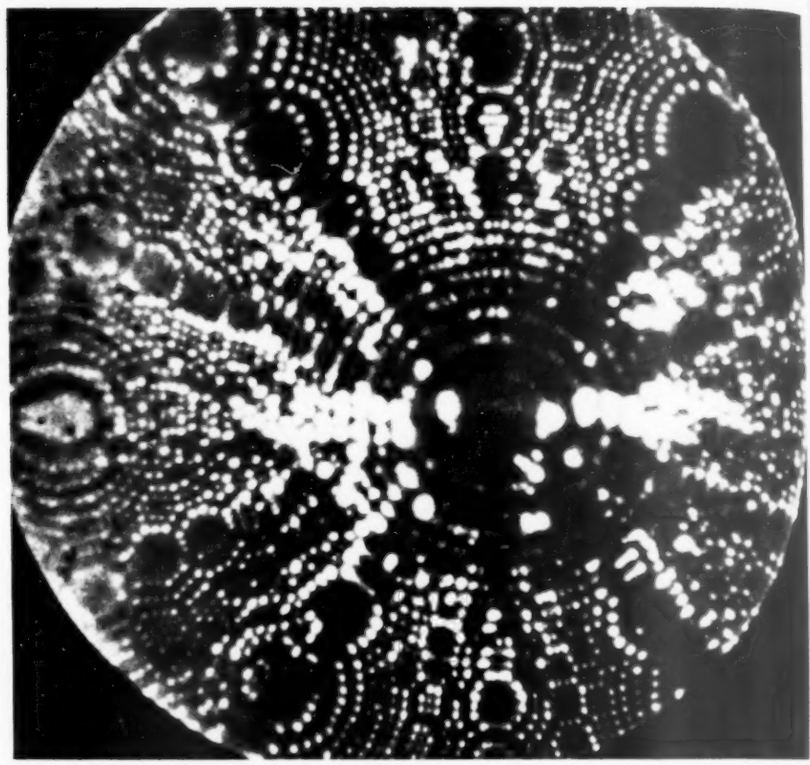
MICROSCOPE THAT "SEES" TUNGSTEN ATOMS



Photograph of point of tungsten needle taken by Dr. Müller showing single atoms on surface.

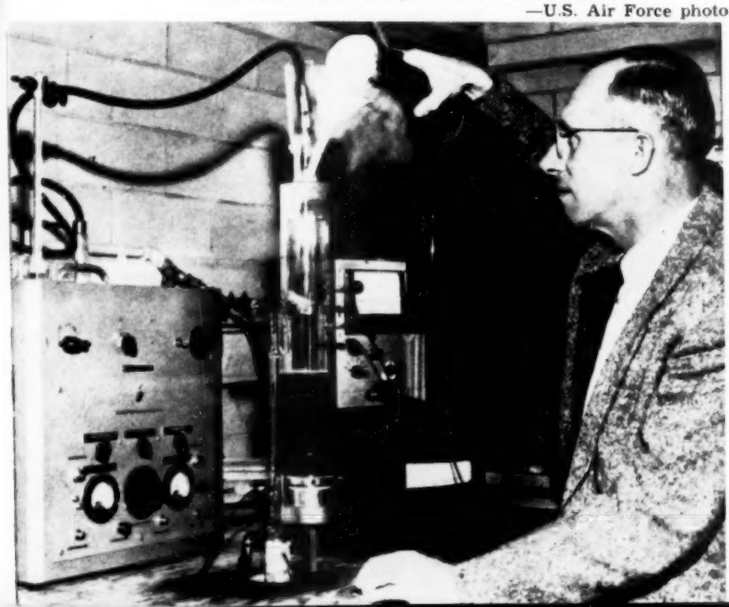
BALTIMORE, MD.—For the first time in history, single atoms on the surface of a solid (tungsten) have been photographed. Tungsten atoms are approximately 5 one-thousandths of one-millionth of an inch in diameter.

Using the field ion emission microscope which he invented, Dr. Erwin W. Müller, professor of Physics at Pennsylvania State University, took the photograph in late 1955.

Dr. Müller's astounding achievement, performed while working under contract for the Air Research and Development Command, will permit the study of films lying on the surface of metals. This, a recent announcement by the Air Research Command states, will afford answers to questions of surface migration of atoms, wetting, oxidation, and reduction, corrosion, friction, wear, and lubrication required by today's pressing military problems.

LIQUID NITROGEN. Dr. Erwin W. Müller, professor of physics at Pennsylvania State University, pours the cooling agent into his field ion emission microscope with which single atoms on the surface of a solid were photographed for the first time in history. The machines are used to apply electricity; sealed in the tube is the tungsten needle; directly below the glass tube is the camera.

—U.S. Air Force photo



Experimenting at Pennsylvania State University with his microscope for four years, Dr. Müller has been working under contract to ARDC's Air Force Office of Scientific Research since 1953.

Present microscopes have been able to "see" surface films from 50 to 20 atoms in diameter. These give good information as to the structure of surface films, but not until the perfection of the field ion emission microscope, which can magnify up to 5,000,000 times, was it possible to view films only one atom in diameter.

The field ion emission microscope consists of an evacuated glass tube containing a minute quantity of helium. Sealed in the middle and pointing toward a fluorescent screen is an extremely fine tungsten needle. A very high voltage is applied between the point of the needle and the screen. The helium gas is ionized very close to the tip, and these ions stream radially from the point to the screen, giving an enlarged projection of the tip surface.

The field emission microscope is a useful tool for investigating the influence of surface films such as oxygen, water vapor, and hydrogen on atomic surface migration, creep of metals at high temperatures, corrosion, and the effects of nuclear radiation on the individual atoms in a solid material.

Using this microscope, it has been found that the high temperature creep properties of extraordinarily high temperature strength alloys of molybdenum and tungsten silicides are improved by the presence of a surface film of oxygen.

It also has proved useful in studying important problems of the production of high temperature alloys, cathode sputtering, effects of temperature and electric field strength on work functions of single crystal planes, optical and field excitation of adsorbed atoms and field emission into liquid and solid insulators.

(From ARDC Release)

SEEING ATOMS IN A MICROSCOPE

By Erwin W. Müller

Professor of Physics
The Pennsylvania State University

(In this article, prepared especially for the Journal, Dr. Müller explains how he conceived the Ion Emission Microscope and describes its application in the photographic study of metal surfaces. This research was supported by the U. S. Air Force through the Air Force Office of Scientific Research of the Air Research and Development Command under contract AF 18 (600-672)—Ed.)

Speaking of atoms in the age of nuclear physics no longer seems exciting. Too many people are inclined to believe we already know "everything" about atoms, and only very few realize that we have had no means even to see them. Studying a vapor trail in a cloud chamber, a trace in a photographic emulsion, a minute light flash in a fluorescent material or triggering the gaseous discharge in a Geiger counter was about the only way of detecting the presence of a single atom, which had already passed when the event was recorded. For seeing atoms at rest, for instance at the surface of a solid, one would need a most powerful microscope, with a magnification of perhaps a million times, a resolving power equaling the distance of neighboring atoms, about 3 Å, and which gives enough contrast and intensity for depicting the desired details. Such a device can now be made—it is the Low Temperature Field Ion Microscope.

The new microscope is based on an almost ridiculously simple principle that was conceived by the author 20 years ago.[1] This old field electron microscope (Fig. 1) consists of a fine metal needle mounted opposite a fluorescent screen in a vacuum tube. If a few thousand volts are applied between the negative needle and the positive screen, the field strength at the tip of the needle reaches about 40 million volts per centimeter and causes the emission of electrons from the cold tip. The tip has a perfectly smooth and almost hemispherical surface, and since the electrons are emitted perpendicular to each surface element, an enlarged electron image of the tip surface, which is the specimen, is projected on the screen. Evidently, the magnification of this microscope is given by the ratio of tip radius and tip screen distance. By proper etching and heat polishing processes perfectly rounded tips with radii even below 1,000 Å (that is 10^{-5} centimeters or four millionths of an inch) can be made, yielding a million times magnification at 10 cm screen distance. This field electron microscope, for instance in the form of a commercial research

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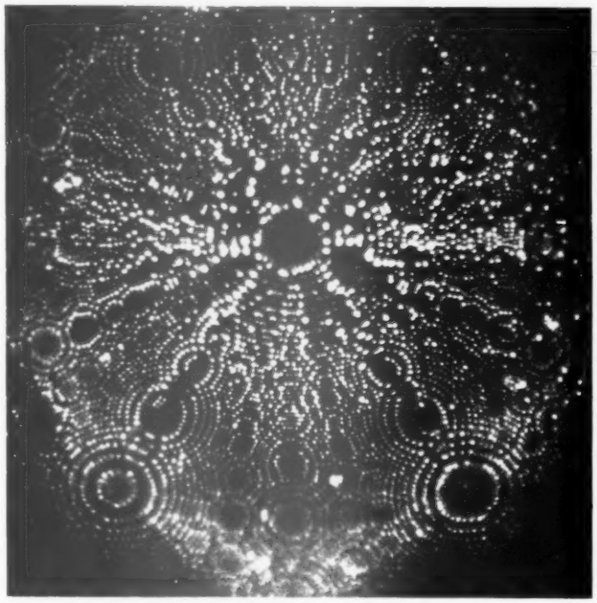


Fig. 3. Ion image of a tungsten single crystal spherical cap, radius about 1000 Å, made with helium ions, at 19,000 volts, tip temperature 21° K. Magnification of original print 320,000 times. In center is 011 plane, close to the bottom to the left and right, the 112 and 121 planes. Many high index net planes show all the single atoms they consist of.

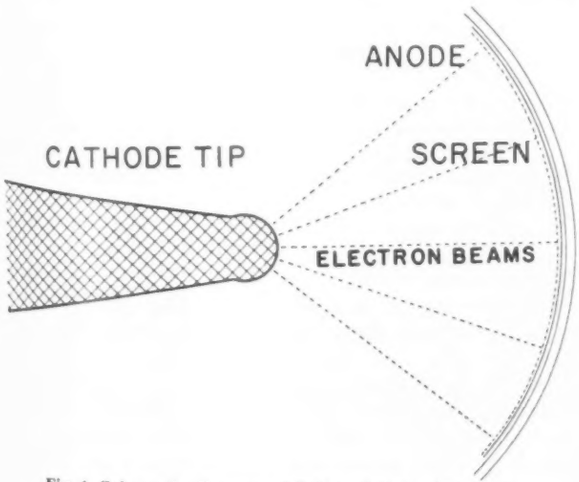


Fig. 1. Schematic diagram of field emission microscope.

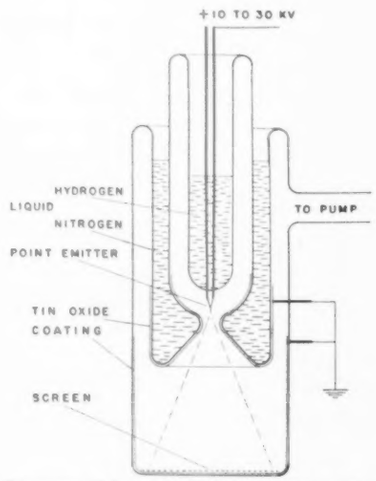


Fig. 2. Diagram of low temperature field ion microscope.

—Olin Photo

The Western Cartridge Company, forerunner of Olin Industries, Inc., used this building around the turn of the century at East Alton, Illinois. Here Franklin Olin manufactured ammunition, using black powder from the mill he had founded a short distance away in 1892. Olin became a major contributor to the national defense.

—P.F.I.

East Alton, Illinois—birthplace of Olin Industries, Inc. This is one of the largest Olin Mathieson plants today. Here the Corporation manufactures explosives, ammunition, brass and other non-ferrous alloys in coils and sheets, fabricated metal parts, and Olin "ROLL-BOND," a unique product which embodies tubing in a single sheet of metal.

OLIN MATHIESON CHEMICAL CORPORATION AND ITS ROLE IN DEFENSE OF THE NATION

By WILLIAM C. FOSTER, *Executive Vice President*

Olin Mathieson Chemical Corporation

Franklin Olin started with one small powder mill and struggled to the top; Mathieson took salt and limestone and built a thriving alkali business; Winchester developed a rifle famed as "The Gun That Won the West"; Dr. Squibb established the first standards of purity and efficacy in the drug and pharmaceutical business and also developed the first pure ether. These are some of the traditions of Olin Mathieson Chemical Corporation. . . .

IN 1892 TWO SMALL industrial companies were founded at far-flung points in the nation. One was the Equitable Powder Manufacturing Company (forerunner of Olin Industries, Inc.) founded in East Alton, Illinois, by an energetic businessman, engineer, and inventor, Franklin W. Olin. The other was the Mathieson Alkali Works, established in Saltville, Virginia, by a group of businessmen who had obtained the rights to the name and processes of Neil Mathieson, an English chemical manufacturer. Both companies grew to approximately the same size in the following years.

In August, 1954, Olin Industries, Inc., and Mathieson Chemical Corporation merged to form Olin Mathieson Chemical Corporation. This is the company that has grown to rank fourth among chemical manufacturers of the nation, a company whose rate of growth in recent years has been outstanding and which promises to have even greater gains within the next ten years. Today Olin Mathieson is a company with annual sales of approximately $600 million and assets of over $600 million. It has more than 44,000 employees located in over 70 plants and 200 offices throughout the world. Its stockholders number more than 43,000.

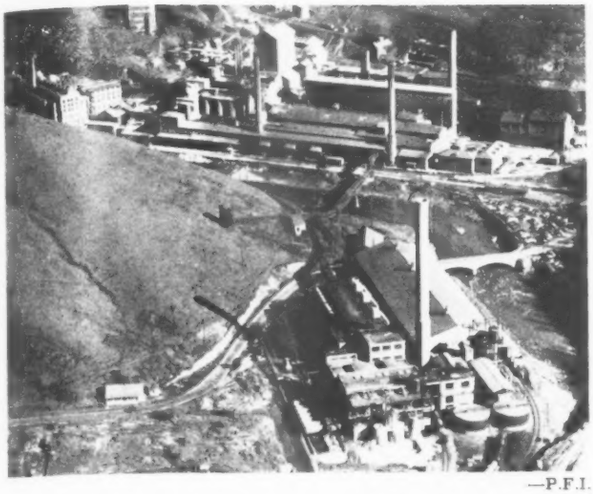
This is the seventh in a series of articles on the origin, development, and product fields of the sustaining member companies of the Armed Forces Chemical Association which reflect the vital role of chemical science and industry in the National Defense. The next article in this series is scheduled for the January-February 1957 issue.—Ed.

Although Olin Mathieson is interested primarily in the future, it is also rich in the past. Any discussion of its history must necessarily contain discussion of such famous and historic organizations as E. R. Squibb & Sons, Winchester Repeating Arms Company, Western Cartridge Company, and others, all of which are now integrated parts of the Corporation. These various components of the present corporation have all played vital parts in the defense of the nation, dating as far back as 1858 in the case of Squibb.

OLIN INDUSTRIES, INC.

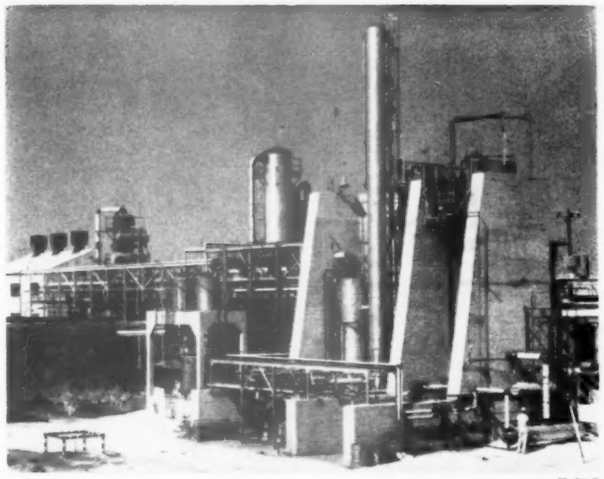
F. W. Olin started the company that was eventually to bear his name in one small powder mill and with a handful of employees. After serving the coal fields of Illinois for several years by supplying them with black powder, Olin found that he needed other outlets for his excess production. He logically turned to ammunition manufacturing and in 1898 formed the Western Cartridge Company, which became Olin Industries, Inc., in 1944.

When competition prevented him from securing the necessary component parts for ammunition, Franklin Olin was forced to make his own bullets, shot and wadding, and to fabricate brass for cartridge cases. Thus he embarked on a long trail of diversification, which was



—P.F.I.

Saltville, Virginia—birthplace of Mathieson Chemical Corporation. Utilizing salt and limestone found in the immediate area, the Saltville plant produces soda ash, caustic soda, bicarbonate of soda, fused alkalies, dry ice, and chlorine. Saltville was the major source of salt for the Confederacy during the Civil War.



—P.F.I.

Hydrazine, produced in this plant at Lake Charles, Louisiana, is a new industrial chemical which has possibilities as a rocket propellant, particularly in very long-range missiles. Pioneered in this country by Mathieson, hydrazine also has uses in many compounds of non-military value, particularly in growth retardants.

to be continued by his sons, John and Spencer Olin, to an even greater degree.

Western Cartridge Co.

During World War I, Franklin Olin increased his explosives and metals manufacturing facilities to meet huge government orders. Like all other commercial manufacturers of sporting ammunition, Western Cartridge Company accepted contracts for military ammunition offered by friendly foreign nations. Western fulfilled 26 of these foreign contracts and was the only company permitted to retain its own primer specifications for cartridges furnished to the United States and its Allies.

Enters the Metals Business

The great wartime need for brass had created a shortage of this metal for cartridge brass and primers. In order to supply the metal needs for its military contracts, Western constructed its own brass mill. When the war was over, Olin was left with metal fabricating facilities far in excess of his normal commercial ammunition business. He then turned to making "tailor-made" brass and other copper alloys, chiefly in strips, sheets and coils. The ability to manufacture to the fine specifications required by ammunition manufacturing enabled him to find a ready market for these products—largely in the growing automobile and electrical appliance fields.

The Winchester Repeating Arms Co.

In 1931 Olin purchased the historic Winchester Repeating Arms Company, of New Haven, Connecticut, which had been founded in 1866. (A predecessor company, the Volcanic Arms Company had been founded in 1855, replaced in 1857 by the New Haven Arms Company, and in 1866 by Winchester.) Winchester was perhaps the most famous and respected name in the arms and ammunition industry. The Winchester rifle had long been known as "The Gun That Won the West." Indeed, the name "Winchester" had become almost synonymous with "rifle" to the pioneers and frontiersmen who used Winchesters to provide themselves with game for food, protect themselves against marauding wild animals such as bear and mountain lions, and to maintain the law of the wilderness. The acquisition of Winchester cemented Olin's position in the small arms and ammunition business, provided further outlets for its explosives production, and provided a natural adjunct to "Western" ammunition products which it was already making.

Winchester in the National Defense

During the Civil War, the infant Winchester company provided a limited number (1,731) of Henry repeating rifles and nearly five million cartridges to the Union forces, but the Army was not as yet ready to fully accept a repeating rifle. Military leaders were afraid of the reliability of a repeating rifle in comparison with the old single-shot stand-by they were using. The Henry rifle was bought by some individuals and provided by some units as their preference, and wherever used, proved its superiority. One of the most colorful tributes to the Henry rifle was made by a Confederate soldier, who said: "Give us anything but that damned Yankee rifle that can be loaded on Sunday and fired all the week."

During the Spanish-American War, Winchester received an order for ten thousand musket-type Model 95s. Three years before that, the company had contracted to supply 15,000 bolt-action repeating rifles to the United States Navy.

By World War I, Winchester was in a position to become a major defense supplier. The company produced nearly 600,000 rifles, over 19,000 riot guns, and nearly 600 million rifle and pistol cartridges, as well as millions of other military items.

World War II Contributions Of Olin Industries, Inc.

In addition to its own small arms and ammunition manufacturing operations, Olin Industries was entrusted with the direction of several government owned plants during World War II and in the Korean War. In the summer of 1943, overall employment in all Olin plants, including those operated for the government, reached a peak of 61,685 men and women. Some idea of the World War II activities of Olin Industries can be gleaned from these achievements:

The St. Louis Ordnance Plant, operated by an Olin subsidiary, alone produced almost seven billion rounds of ammunition, more than the total of all the small arms plants in World War I. If laid end to end, the cartridges produced in this plant would have circled the earth at the equator 18½ times or a total of 455,471 miles.

—P.F.I.

Automatic gun-stock carving machine in Winchester plant at New Haven, Connecticut. Winchester, established in 1866, has been famous for its quality-made rifles and shotguns ever since. Winchester has contributed to the national defense since Civil War days.

View of crane unloading pulpwood in yard outside mill at West Monroe, Louisiana, headquarters of Olin Mathieson's Forest Products Division. This division produces kraft paper, paper bags, multi-wall sacks, corrugated shipping containers, lumber, flooring, utility poles and other wood products.

The total output of Olin's Western and Winchester plants, including the St. Louis output, came to 15 billion loaded rounds of service and training rifle and machine gun cartridges. In addition the Olin factories produced 1½ billion pounds of cartridge metal, more than 100 million pounds of aluminum and many other items of military necessity.

In the early days of World War II, Winchester developed in 13 days at New Haven the pilot model of the U.S. Carbine, caliber 30 M-1, and later produced almost a million of these for the Armed Forces. Winchester was the only commercial organization engaged in the production of the 30 caliber Garand semi-automatic rifle and manufactured more than half a million of these.

Cellophane Manufacturing

As early as 1929 Olin had contemplated engaging in cellophane manufacturing because of the cellulose chemistry "know-how" it had acquired in the explosives field. The company had constructed a machine which manufactured a high grade of cellophane and was busily engaged in solving the more difficult problem of coating. In 1949 it became possible to enter the cellophane industry under DuPont licenses so that further study was unnecessary.

Ecusta Cigarette Paper

At the time the agreements with DuPont were negotiated, an ideal cellophane plant-site was available at Pisgah Forest, North Carolina. The company acquired the Ecusta Paper Corporation there, a leading manufacturer of cigarette and other fine flax papers (thereby entering a related cellulose activity). The cigarette paper operation was unusually like that of cellophane, except for the raw materials used, and therefore facilitated the operation of the cellophane plant which was built there. The creation of the film and paper divisions were natural extensions into the new field of chemistry in which the company had set its course. Later, the Film Division also engaged in the manufacture of polyethylene film and tubing.

Forest Products

One requirement which the company foresaw when it entered the cellophane field was the acquisition of a sufficiently large supply of timberlands to support a pulp mill when needed and economically justified. Accordingly, Frost Lumber Industries, Inc., with 435,000 acres of standing timber in Arkansas, Texas, and Louisiana, was acquired in 1951.

In 1952 Olin purchased Ramset Fasteners, Inc., of Cleveland, Ohio, and the company entered the expanding field of powder-actuated industrial tools, with its ammunition facilities manufacturing the cartridges for the tools. Olin had long served the coal mining industry with its explosives, and in 1952 it acquired an interest in the Armstrong Coalbreak Company of Benton Harbor, Michigan, which holds basic patents and sells and services equipment for the new and rapidly growing technique of mining coal by compressed air.

Thus, by the time of the merger with Mathieson Chemical Corporation, Olin Industries, Inc., was manufacturing a number of diversified high quality products in ever-widening and related fields based essentially upon chemicals and metals.

MATHIESON CHEMICAL CORPORATION

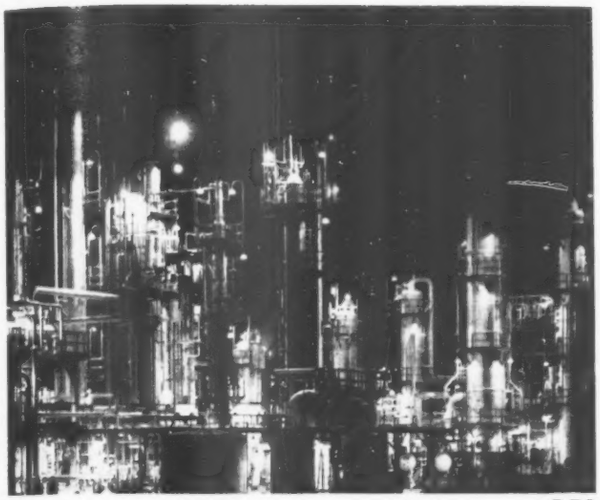
In the same year that Franklin Olin was getting his small black powder mill under way in East Alton, Illinois—1892—a group of seven businessmen from New York, Rhode Island, and Virginia were laying plans for a new company to engage in the manufacture of alkalies —to serve the rapidly growing needs of the glass, textile, paper and other industries of the East.

About this time, Neil Mathieson, an English chemical manufacturer whose plant near Liverpool had long been a producer of alkalies for the American market and whose name and products were well and favorably known among U.S. users of chemicals, decided to dispose of his factory in England. The new American group acquired the rights to the Mathieson name in America, since it planned to manufacture products of a quality that would be equal to those of the British concern. Neil Mathieson's son, Thomas, was asked to come to the United States to build and supervise the first plant.

Soda Ash and Caustic Soda

This was the beginning of the Mathieson Alkali Works, as the company was known until it changed its name to Mathieson Chemical Corporation in 1948.

A plant to manufacture soda ash and caustic soda was built at Saltville, in the extreme southwest corner of Virginia, an area rich in salt, limestone, and coal. The region had, in fact, been the chief source of salt for the Confederate States during the Civil War. On July 4,



—P.F.I.

Night view of petrochemicals plant at Brandenburg, Kentucky. This plant utilizes liquefied petroleum gas strippings from a natural gas pipeline to produce ethylene oxide, ethylene glycol and other organic chemicals.

—P.F.I.

Distillation equipment of the ethylene glycol unit at Olin Mathieson's Brandenburg, Kentucky petrochemicals plant, which utilizes liquefied petroleum gas strippings from a natural gas pipeline.

1895, the first Mathieson product, soda ash, was shipped out of Saltville.

The new company soon found it desirable to expand its operations, and began to follow a basic pattern of extending itself to related products and into allied fields that has continued into the present.

For example, salt and limestone were the raw materials used to manufacture soda ash and they could also be used to produce bleaching powder. In 1896, the second year of its operation, the Saltville plant began the first commercial production of bleaching powder in the United States. This was made possible by Mathieson's introduction from England of the Castner electrolytic cell for the production of caustic soda and chlorine from salt brine.

For the Castner cell to be economically successful, however, lower cost power was needed than that available at Saltville. So in 1897 this portion of the Saltville operation was dismantled and a new and larger Castner cell was installed at Niagara Falls, New York, where the falls provided an ample supply of low-cost hydroelectric power. This was the beginning of the present Niagara Falls plant. Also, the Castner cell was the forerunner of the present Mathieson stationary mercury cell, one of the most efficient chlorine-alkali cells in use today. This cell was developed by Mathieson engineers and is in use at the Saltville and McIntosh, Alabama, chlorine-caustic plants.

Liquid Chlorine

In manufacturing chlorine, Mathieson was led logically to an allied product—liquid chlorine. For many years bleaching powder, a product consisting of chlorine absorbed in lime, was the only way of shipping chlorine industrially. It had long been known that chlorine could be liquefied under proper conditions, but suitable compressing equipment was lacking, as well as satisfactory containers for shipping the liquefied product. Work on this problem was begun by Mathieson in 1908, and the first commercial production and shipment of chlorine was started by the company in 1909, with small steel cylinders as the shipping container. In 1910, realizing that larger containers would be necessary, Mathieson engineers built the first one-ton cylinders for chlorine, large numbers of which were placed in service during World War I. Another chlorine shipping problem was the design of a satisfactory cylinder valve. Experiments led to the development of a specially designed Mathieson valve, later adopted as standard by the industry.

About 1917, the company began experimental work on fixation of nitrogen from the air, a critical problem during World War I because of the possibility that natural nitrates from Chile might be shut off. After intermittent production beginning in 1919, a synthetic ammonia process was perfected and the first unit was put in operation at the Niagara Falls plant in 1923. This was one of the earliest successful synthetic ammonia operations in the United States. Today the company's anmonia facilities at Lake Charles, Louisiana, and Morgantown, West Virginia, as well as Niagara Falls, make it a major producer in this industry.

Mathieson in World War I

In 1917, with the nation confronted by the first World War, the need for chemicals of every kind became acute. Increased production of alkali and chlorine for war purposes became essential, and Mathieson exerted every effort toward this goal, devoting itself almost exclusively to war production. Chlorine production, especially, was greatly expanded during the war for use in war industries.

Dry Ice and Other Products

The manufacture of soda ash and caustic soda led to the production of such other products as fused alkalies, bicarbonate of soda, dry ice, and carbonic gas which involved the use of salt or limestone as a raw material, or both. The manufacture of fused alkalies in briquette form started in Saltville in 1923. This was the beginning of the line of specialties for metal refining and water softening made by Mathieson today. A dry ice plant was added at Saltville in 1931, and in 1937 carbonic gas production was started. Today Olin Mathieson's dry ice plant is the largest in the world. The product is distributed by means of specially-designed railroad cars and a network of 18 dry ice warehouses from New York to New Orleans.

(Continued on page 31)

ORGANIZATION OF THE ARMY CHEMICAL CORPS

FIGURE 1

The major phases of the reorganization of the Army Chemical Corps pursuant to recommendations of the special committee* appointed by Major General William M. Creasy, Chief Chemical Officer, have been completed.

The committee consisted of: Mr. Otto N. Miller, Vice-President for Operations of Standard Oil Company of California, Chairman; Mr. Hans A. Klagsbrunn, senior member of the Washington, D.C. law firm of Klagsbrunn, Hanes and Irwin; Dr. James A. Shannon, Director, National Institutes of Health, U. S. Public Health Service, and Mr. George H. Watkins, Vice-President, University of Chicago, and Dean of the Business Management School.

Organization—Primary Structure

Under the new organization, the Corps is made up of the following five major elements (Fig. 1): The Office of the Chief Chemical Officer; The Research and Development Command; The Materiel Command; The Engineering Command, and the Training Command.

Major changes are: (1) abolition of the former Research and Engineering Command and establishment of a Research and Development Command; (2) establishment of a Chemical Corps Engineering Command; (3) abolition of the position and organization of the Assistant Chemical Officer for Biological Warfare and incorporation of the major portion of these activities within the Research and Development Command; (4) relocation of Hdqtrs, Materiel Command from Baltimore to Army Chemical Center, Md., and consolidation of this Class II** activity in the Hdqtrs., Army Chemical Center.

Top Executive Management

The top executive management, (Fig. 2), in addition to the Chief Chemical Officer, consists of the following:

The Deputy Chief Chemical Officer, who coordinates the operational activities of the Corps, provides guidance and instructions on long-range plans, programs and policies, and acts for the Chief in his absence.

The Deputy Chief Chemical Officer for Scientific Activities, who is the chief scientist of the Corps, directs and controls the research and development, and engineering activities.

The Chemical Corps Executive Director, the senior civilian executive whose responsibilities include participation in the over-all management.

The Assistant Chief Chemical Officer for Planning and Doctrine, who has specific responsibilities in the areas of planning and doctrine and also assists in the over-all management.

Comptroller

The comptroller organization of the Corps has been modified extensively. Comptroller offices at headquarters of the major commands have been abolished. The Comptroller assumes the responsibility for furnishing command level comptroller services to the major commanders. Installation level comptroller arrangements are essentially as before, with the exception that the Comptroller at Army Chemical Center furnishes certain services to the Materiel Command.

Program Coordination

The focal point of the programming activities under the Army Program System is located in the Program Coordinating Office of the Office of the Chief. It is responsible for coordinating all Chemical Corps programming activities.

Planning and Doctrine

The basic function of the Assistant Chief Chemical Officer for Planning and Doctrine is the development of long-range military planning and the formulation of Chemical Corps doctrine involving other military estab-

*Resume of this report is published in the September October 1955 issue of the JOURNAL.

**A Class II activity is a staff agency of a Department of the Army branch which is primarily logistical in nature.

lishments as well as the Department of the Army. In his organization are located the Plans and Training Division and the Combat Developments Division, whose functions include war planning schedules, preparation of troop bases and the bulk of Chemical Corps training responsibilities. The Combat Developments Division also includes supervision of the liaison group recommended by the Miller Committee. Initially, five such liaison officers are provided for, who, for administrative purposes are assigned to the Chemical Corps Board. The Nuclear Effects Adviser, who provides technical assistance and policy guidance on radiological warfare, also is included in this Division.

The following Class II activities are included under the technical supervision and operational control of the Assistant Chief Chemical Officer for Planning and Doctrine:

Chemical Corps Training Command, Ft. McClellan, Ala.;

Chemical Corps Board, Army Chemical Center, Maryland;

Chemical Corps Intelligence Agency, Washington, D.C.

Field Requirements Agency, Fort McClellan, Alabama (formerly Doctrine Division, Hdqtrs., Chemical Corps Training Command).

Logistics Planning Division

Logistics Planning Division (formerly Materiel Division) has been formed in the Office of the Chief to provide staff support in certain logistical areas. Requirements determination and supply control for Chemical Corps military items are included here to assure the responsiveness necessary to the Chief Chemical Officer and higher authority in matters pertaining to materiel procurement and supply. Included also are the production planning activities involving procurement and industrial mobilization.

Individuals experienced in policies relating to small business, distressed labor areas, Buy American laws, etc., are available in the Materiel Advisory Staff of the Logistics Planning Division.

Career Management Division

A Career Management Division has been established to develop and execute a positive program designed primarily for long-range career planning for the Corps' civilian and military personnel. Guidance and staff assistance is provided to subordinate Chemical Corps elements on all phases of personnel management, administration and career development. The development of a "Career Ladder" is stressed by presenting a series of successive training and development courses and assignments designed to bring an individual to his highest useful skill level. Plans also include administering the Reserve affairs program for Chemical Corps Reserve Officer personnel and also a career management program for enlisted military personnel assigned to the Chief Chemical Officer. Provisions are also made for the professional staffing of the Chemical Corps School, and the review of the results of military education received.

Administration Division

The Administrative Division has the functions of Technical and Public Information, Safety, Welfare and Morale, Military History, and the administrative support of the Office of the Chief Chemical Officer and Chemical Corps Class II field activities located in Washington. The activities of this Division are staff supervisory in nature as they relate to the Chemical Corps commands and installations, and operational to the extent that they provide direct support to the Office of the Chief Chemical Officer.

Research and Development Command

The new Chemical Corps Research and Development Command has charge of the research and development activities in both the biological and chemical fields which have heretofore been under the command of separate organizational units within the Chemical Corps. It, along with the recently created Engineering Command, reports directly to the Deputy Chief Chemical Officer for Scientific Activities, who has responsibility for directing the research, development, and engineering programs.

The commander, the deputy commander and the deputy for scientific activities, including a small staff of key

(Continued on page 28)

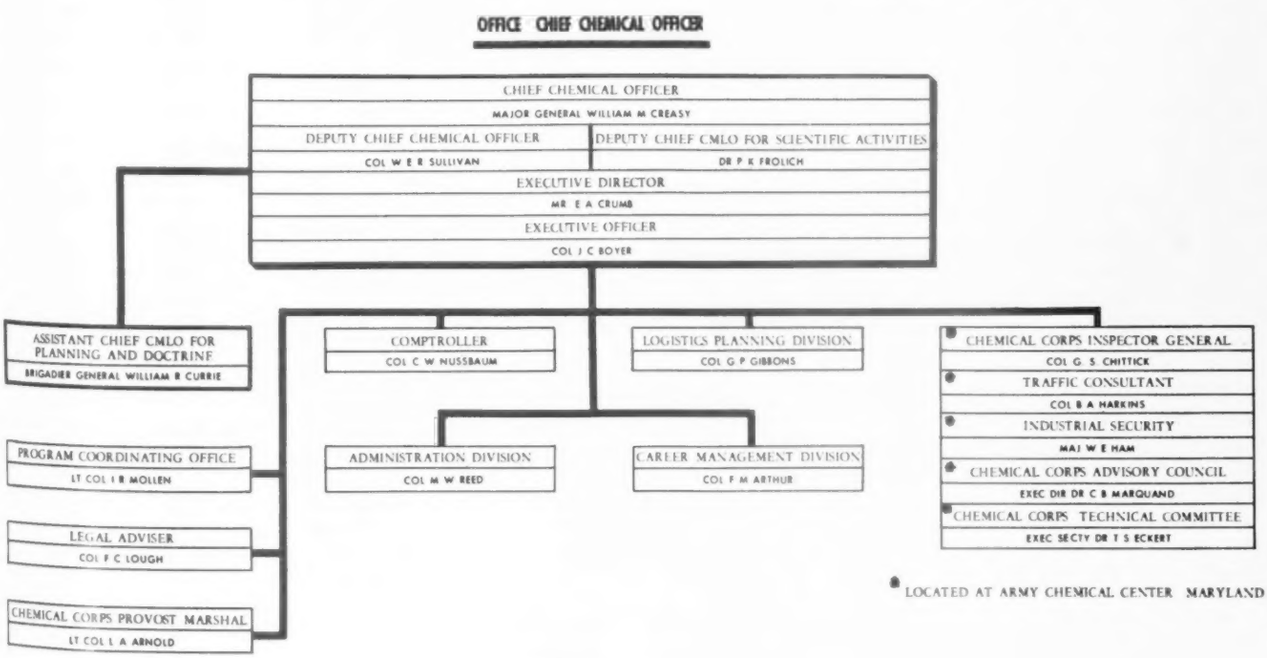


FIGURE 2

CAREER AND PERSONNEL MANAGEMENT WITHIN THE CHEMICAL CORPS

Summary of a Presentation for the Management Subcourse of the 10th Advanced Officers' Course, Chemical Corps School

By COLONEL FRANK M. ARTHUR

Chief, Career Management Division
Office of the Chief Chemical Officer

THE CAREER MANAGEMENT DIVISION, Office of the Chief Chemical Officer, has staff responsibilities for personnel management and career development activities of the Chemical Corps. The organization and present mission of the division date from 21 November 1955. The present element is designed to implement fully the career development concepts of the Miller Committee. The Division consists of an executive element and four branches: Civilian Personnel, Military Personnel, Career Plans and Policies, and Records and Statistical. Current manning levels provide for seven officers and forty-five civilians.

Although the military service has had a long and continuing training and educational program, the current emphasis upon career development is of recent origin. Many of the current concepts and practices within this area are developments since World War II.

The primary objective of all career development activities within the Chemical Corps is directed toward the creation of an effective *military-civilian team*. The various programs for development, however, are governed by two separate regulatory systems which have been established by separate legislation. Hence, the peculiarities of each system must be recognized and the overall military-civilian team concept must be responsive to both systems, while at the same time aimed at a common goal.

The field of career management is so new, generally as a formal concept, that no full doctrine has been developed. To say, "practice good leadership," is too sweeping—such approach does not give the practitioner necessary guidance. We in the Career Management Division, Office of the Chief Chemical Officer, have, as a result of investigations and research, postulated certain principles or tenents pertaining to career management. These views, however, will require considerable usage, refinement and study before they will be published as basic doctrine. I shall now discuss, briefly, what we believe as the basic guide lines underlying any comprehensive and dynamic career management program.

AN EFFECTIVE CAREER management program in any organization can only be maintained by direct participation and support of management itself. Such participation and support within the Chemical Corps must stem from the Chief Chemical Officer and his top management officials through the entire Corps command structure. The participation and support of the Command element, moreover, must be aggressive and continuous. Career management, moreover, is neither a fad nor a panacea. It cannot be bought. It must be practiced. It starts at the top within an organization and filters down.

A corollary of the principle just discussed was pointed out recently by Mr. John W. Macy, Jr., Executive Director of the U.S. Civil Service Commission. Mr. Macy said, "We cannot afford to regard personnel administration as a 'sideline' or a 'specialty' which lives an independent existence of its own, with its own cut and dried techniques and trappings."

Basic to a dynamic career management program is the concept that each supervisor and manager is personally responsible for the individual development of the people reporting directly to him. This concept applies to staff personnel as well as to line commanders. All employees must be included within the provisions for career management. The personal responsibility includes periodic appraisal, counseling, and guidance interviews where one's strengths and weaknesses are discussed with him as well as a development plan for him to follow. Such plan is designed on a personal basis to insure reinforcing strengths and overcoming weaknesses.

Another principle is that all segments of the program must be flexible to permit adaptation to the needs of the individual and of the organization. Career management must be conducted with concern to the development needs of the individuals concerned. A corollary of this notion is that programs must be individually tailored to meet the needs of the employees and the organization. Total development of the individual and the management team cannot be done on a blanket approach. This is not to say, however, that certain training and education will not be provided, on a selective basis, to groups as required by the situation.

The primacy of command participation in career management activities does not minimize the staff assistance necessary to support a total program within any organization.

THE EFFICIENT ACCOMPLISHMENT of the Chemical Corps mission depends in very large measure on the discovery, development and ultimate utilization of its human resources.

Individual growth and development is largely a product of one's own input. General Creasy at the MATCOM Seminar analyzed it this way: On a pie-chart of ten equal sub-divisions, seven of these segments should be marked "plain hard work by the individual." The remaining three segments should be marked luck, flexible pre-planning, and outside assistance, respectively. These are the factors influencing one's career development. On any scale, the major part of the input rests squarely with the individual.

The consensus of a group of top executives at a round-table conducted in November, 1954, by Columbia College was that ninety percent of one's growth and development is the result of one's own efforts. Career management, moreover, requires real initiative on the part of all participants—both management and employees.

Career management is total. It must provide for ma-

turity in all directions including development in off-the-job interests. It must also include all motivational elements necessary to insure total and full participation by all employees.

Career management is not a program to guarantee promotion nor is it a device to establish a select group of employees who will receive special favors and prerogatives. Rather it is designed to increase the competence of all employees—both military and civilian.

Career management must provide the career opportunities which result in the growth, development, and satisfaction of the employees. It must insure a sufficient number of high-level jobs to provide incentive for career employees. It must also encourage healthy competition for advancement.

THE MILITARY-CIVILIAN TEAM concept within the Chemical Corps must permit an independent and mutually complimentary staffing. Chemical Corps military and civilian personnel *together* provide the requisite tactical and nontactical leadership; the experience; the managerial, professional and technical skill; the intimate knowledge of the Corps and its role in the total defense program, and the sense of urgency required for superior performance. In a letter of 10 January 1956, addressed to all Chemical Corps officers, General Creasy said:

"Research and development, per se, is accomplished largely by the civilian personnel of the Corps with the active participation and support of the military. When a career officer is placed in a research and development 'slot' for a tour of duty, he should come there with a military perspective and should insure that the *military* perspective is maintained within the area to which he is assigned. Just as the civilian scientist with an adequate military background may find some aspects of his work clarified by virtue of his military experience, so the military man with scientific training and experience may get a more profound understanding of certain aspects of research and development. On the other hand, there is sometimes a regrettable tendency for officers with such dual training to submerge themselves too deeply in detailed scientific matters, thereby obscuring their military perspective. The primary job of a Chemical Corps officer is a military one; he should *not* be in competition with the civilian professional personnel, who by specialized training, long tenure and concentration of interest, have become experts in their particular fields.

"Using our capable civilian professional personnel, together with officers trained in military command and staff matters, we can weld a strong civilian-military team dedicated to doing an outstanding job on projects of true military significance."

The concepts outlined by General Creasy might equally be applied to all fields within the Chemical Corps structure.

Dynamic career management can espouse no single system, technique, or program of development. Rather, it must embrace all development devices and programs necessary to achieve the development of the individual and the management team necessary to produce a balanced and efficient work force for the Chemical Corps.

Basic objectives in management development are simple and almost obvious:

"1. To improve performance of operations.
2. To increase the capacity of managerial personnel for additional responsibilities and increasing complexity of operations.
3. To provide opportunity for individual growth and self-expression, to produce leaders.
4. To insure that management practices are modern and progressive.
5. To establish the basic principle that executive development cannot be left to chance, but must be scientifically planned and aggressively executed." [1]

In the final analysis, people cannot really be developed; they must be encouraged and persuaded to develop themselves. It is management's responsibility to make available the tools for development and to establish a climate conducive to personal improvement and advancement. Under such circumstances, the man with the required potential will voluntarily—and aggressively—avail himself of the opportunities afforded.[2]

The Chemical Corps career development and personnel management programs and activities are oriented to a full and complete participation by line and staff at all echelons of command.

Our Chemical Corps career development programs are being built and implemented on the basis of long-run objectives. We are, however, making significant and identifiable immediate gains in many of our areas. From three to five years will be required to achieve our total systems and from five to ten years will be required before we attain our maximum benefits from this system and its programs.

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[1] Major General William M. Creasy, "Scientific Management in the Chemical Corps," Armed Forces Management, April 1955, p. 6.
[2] *Ibid.*, p. 7.

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THE CHEMICAL CORPS SEARCH FOR CHEMICAL WARFARE AGENTS

By R. MACY

Directorate of Research
Chemical Warfare Laboratories
Army Chemical Center, Maryland

THE RESEARCH ACTIVITIES of the Chemical Corps are among the least publicised of Army functions. It is consequently considered appropriate to preface this article with a brief statement of the nature of the research organization in the Chemical Corps, as shown in Fig. 1.

The Chemical Warfare Laboratories have as a major interest the search for chemical warfare agents more lethal than those presently standardized, or in some other manner more desirable than known agents for use in chemical munitions. Lethality is naturally a prime factor in this search for useful compounds, since in many battle situations chemicals may be called upon to supplement or even replace bullets in order to subdue an enemy. However, the unique ability of chemical agents to destroy an enemy's will to fight is now recognized as a highly important aspect of this type of warfare.[1] Chemical warfare can be non-destructive. Compounds which can incapacitate without killing are sought in this program, as well as lethal agents.

The principal purpose of this review is to enlist the aid of the chemical public in the search for substances which will enhance the ability of the Chemical Corps in any future war to fight its type of battle.

Understandably, security restrictions prevent making a public statement of the current ability of the Chemical Corps. However, this outline of the manner in which the search for chemical warfare agents is conducted should be of interest to chemists in general, and it is hoped that it will excite their interest in helping to further the program.

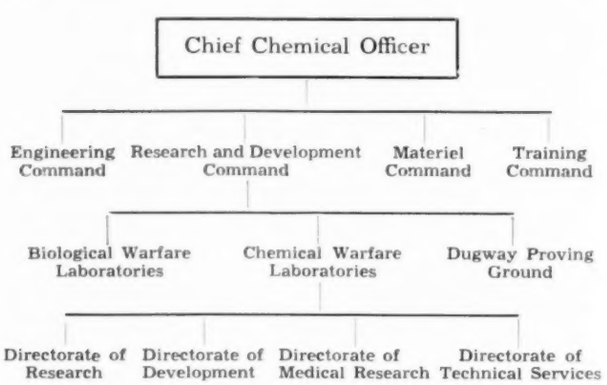

Figure 1. Brief outline of the research organization in the Chemical Corps, under the Research & Development Command. This current organization was established 1 February 1956.

Internal Research

Research activity in the chemistry research group of the Chemical Corps is principally along two lines. First, there is the Beilstein-Edisonian approach, which means a search of the literature for compounds of known physiological activity which may furnish clues for the synthesis of more toxic compounds. This approach depends on a relation between chemical structure and toxicity which unfortunately is very elusive. Except for the structure-toxicity relations that exist in certain limited series (e.g. cocaine), experts in this field uniformly state that no relationships have been discovered which have such broad usefulness they can be used to predict entirely new toxic structures.

Two of the outstanding discoveries in the field of chemical warfare agents, namely, the vesicant (mustard), and the nerve poison (Sarin), were purely accidental. The accidental aspects of these discoveries, however, may more properly be regarded as illustrations of the principle of serendipity, a term recently made popular by Whitney and by Langmuir[2] of the research laboratories of the General Electric Company. The definition of serendipity given by Langmuir is "the art of profiting from unexpected occurrences." The chemical warfare value of mustard was apparently recognized as a result of an accidental spill on the person of Dr. H. T. Clarke[3] of Columbia University, when working in 1911-1912 in Berlin in the laboratory of Emil Fischer, and the toxicity of Sarin to warm-blooded animals was discovered by Schrader in Germany in the period of 1935-1938 during a search for insecticides.

The second pathway to highly toxic compounds in this internal research is the "natural products" approach. This consists in isolating and screening the active principles of the very large number of substances in nature which are known to have a pronounced physiological action, in an effort to find clues to new toxophoric chemical structures. This type of research is of course as old as chemistry itself. Morphine, for example, was isolated from opium in 1805. Modern experimental methods should make this form of search more rewarding, in that it is now much more feasible to determine structures of relatively complex compounds, whereas the structure of morphine did not become fully known for many years after its isolation.

The principal difficulty in this approach is that many of the highly toxic substances in nature are toxins; in other words, they are protein in composition. For example, botulinum toxin is reputed to be one of the most toxic substances known which have been prepared in pure crystal form.[4] It can be made readily with the aid of bacteria, but the study of its chemical composition which might lead to other potent compounds must wait for further advances in the chemistry of proteins. It is encouraging that these advances are now being made very rapidly, as shown by the recent success in the determination of the structure of insulin, and the synthesis of a pituitary hormone, oxytocin, which is an octapeptide. In this connection it is of interest that although the relatively simple compound, muscarine,

with the efpirical composition $C_9H_{20}N$ is the type of substance with which the chemist is more at ease, its structure is still uncertain.

The Industrial Liaison Program

The Chemical Corps in 1951 enlarged its scope of activity in the Edisonian approach by a systematic solicitation of information from industry, universities, and similar sources. Chemical manufacturers and pharmaceutical companies do not ordinarily seek to make toxic compounds for sale, but obviously there is a good possibility that a research chemist in such an organization may come across a toxic substance in the course of his work. The natural impulse of such a chemist would be to shelve the substance. The existence of such a substance, however, is of great interest to the Chemical Corps, and a determined effort is now being made to discover if it does exist.

It hardly needs to be stated in this review that industry takes great pains to protect its information, and the procedure by means of which the Chemical Corps hopes to obtain and protect such useful information had to be organized with considerable care. In the past, most of the visits to industrial organizations were made by Professor Loyd E. Harris of Ohio State University while on active duty as an officer (Lt. Colonel) with the Chemical Corps. Professor Harris was admirably suited to this task of establishing the foundation for this program on the basis of his long experience in the teaching of pharmaceutical chemistry and his considerable acquaintance with Chemical Corps problems. After the recent reorganization it seemed desirable to strengthen and provide for greater continuity in the program. For this reason, a special section was created in the Directorate of Research to carry out this mission.

The important task was to convince industry that a new compound (non-toxic as well as toxic) or a piece of new information supplied to the Chemical Corps would be maintained and processed in a leakproof manner. This is accomplished at the Army Chemical Center in the Industrial Liaison Office, all the activities and files of which are kept separate and much less accessible than the regular official files. When a new compound suggested for investigation is received, its identity is recorded, the label is removed in order to conceal the name of the source, and a Commercial Secret (CS) code number is assigned to it. After the chemical warfare data files and the CS files have been reviewed to see if this or similar compounds have been screened, the sample, known only by its CS number, is passed along to the appropriate screening groups. Afterward, a small group of research leaders (career Civil Service employees with no industrial connections) pass judgment on the value of the substance for chemical warfare use. The submitter is furnished with an unclassified report of the screening of his compound.

The files of the Industrial Liaison Office are handled with even greater security restrictions than military files and only the immediate personnel of this office have access to them. Only the personnel of this program make contact with the industrial source of information.

Contracts with Industry and Universities

Since 1948, funds at a variable level have been made available to the Chemical Corps for contract assistance in this field of research. Contracts have been let to industrial organizations, research institutes, and to university laboratories for the synthesis of certain series of compounds, when these installations have been found

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to have the personnel, facilities, and experience required for the desired effort. The contracts have been almost entirely a support function, the research effort usually being guided by our supervisory personnel. Support research of this kind is generally not easily acquired because of the security restrictions needed in a program of this type. The delay of two to six months required to clear the working personnel is a serious difficulty, especially for a university contract, since the university work is done as a rule by graduate students who cannot afford to wait for clearances to be effected.

Federal support of basic chemical research was well presented in a symposium before the American Chemical Society Division of Chemical Education in March 1953. The published material[5] describes the procedure by which contracts are sought from, and granted by, several government agencies.

Prime Contract with a Major University

Under the general supervision of a well-known scientist at one of the larger universities a program was started in 1953 with the object of initiating basic research activities of chemical warfare interest among younger research personnel of Ph.D. caliber in universities and other organizations. It is a prime contract, with the sub-contractors principally among university professors in the age group 30 to 40 who have been successful in heading research groups. This is long-term research in which the coordinator will not direct the activities of the research personnel but will follow their work in order to assure the Chemical Corps, through periodic reports, of the nature and merit of the research.

Use of Toxicity Files

The data on file at the Army Chemical Center pertaining to compounds studied for toxic effects is quite large. The information is entered on the usual 3x5 in. cards, in the form of formula indexes, name indexes, and code name indexes. Most of the chemical structure information was recently transferred to IBM cards, from which it is possible to select compounds based on groups or combination of groups without the use of sorting machines. This was done with the assistance of personnel from the Chemical and Biological Coordination Center of the National Research Council in Washington.

Unfortunately, a card index of this nature has not been of much help in the search for new and more powerful chemical warfare agents. This statement is simply amplification of that made in the first section of this review regarding lack of a "general" principle relating structure and toxicity.

Chemical Corps Advisory Council

In December 1946 a Research Council was organized by the Chief of the Chemical Corps "to help determine the direction of its research and development work."[6] It is now known as the Chemical Corps Advisory Council. The first chairman, Dr. W. A. Noyes, Jr., of the University of Rochester, was succeeded by Dr. H. F. Johnstone of the University of Illinois, who was followed by the late Dr. A. P. Colburn of the University of Delaware, and currently by Dr. H. C. Weber of the Massachusetts Institute of Technology. Permanent liaison is maintained by a secretariat under Dr. C. B. Marquand stationed in the sub-office of the Chief Chemical Officer at Army Chemical Center.

The Council is composed of a group of committees. The committee on chemical warfare agents, now headed by Dr. L. F. Audrieth of the University of Illinois, has generally about ten members drawn from industry and universities. The committee meets at fairly regular intervals, closely reviews the research program concerned with the search for lethal and toxic agents, and makes recommendations to the Chief Chemical Officer. Contact with the working personnel at the Army Chemical Center is maintained by frequent visits, and personnel are encouraged to request assistance and advice from committee members when needed.

American Chemical Society Committee Advisory to Chemical Corps

This ACS committee has been in existence since shortly after World War I. The present chairman is Dr. C. C. Price of the University of Pennsylvania. There are four subcommittees, of which the Research Subcommittee under Dr. Roger Adams of the University of Illinois is most concerned with the agents program at the Army Chemical Center. About twenty scientists are normally on this subcommittee and they represent usually a more thorough liaison with industry than the corresponding Chemical Corps Advisory Council. The recommendations by the ACS committee are usually more general than those submitted by the Council, but the members of the committee are just as available for advice and guidance as are those of the Council.

New Agents Research and Advisory Group

The research program for new agents at the Army Chemical Center is carried out principally by teamwork which involves the synthesis of suggested compounds by certain of the research groups, and the toxicity screening of these compounds by personnel in the toxicology laboratories. Representatives from the several research groups comprise a committee which periodically reviews the status and makes recommendations when appropriate with respect to new approaches. Specialists in certain fields of toxicity are often invited to partake in the discussions.

The Chemical-Biological Coordination Center (CBCC) of the National Research Council

The CBCC, in Washington, D.C., was set up in 1945 as the successor to the wartime Insect Control Committee of the Office of Scientific Research and Development. The data in the published literature, as well as in the OSRD files, on the broad relationship between chemical structure and biological activity was to be organized at the Center in such a way as to make the information readily accessible to the scientific public.[8]

A screening program was also organized to permit testing of chemicals for various biological actions and properties. Information on compounds submitted to CBCC is transferred to data sheets which are then transmitted to about 30 screening agencies, each of which specializes in a certain research area. The screening agency which determines toxicity to warm-blooded animals is at Army Chemical Center. Any of the screening agencies interested in studying a given sample may request some of it for test. Through these data sheets, which generally contain a rough statement as to whether or not the substance is toxic, personnel at the Army Chemical Center are in touch with at least a portion of the current research activity in new products which are of interest.

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[4] A. M. Pappenheimer, Jr. *Scientific American* 187: No. 4, 32 (1952).
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[6] *Ibid.* 27: 3848 (1949).
[7] *Ibid.* 25: 285 (1947).

AIR POLLUTION SYMPOSIUM

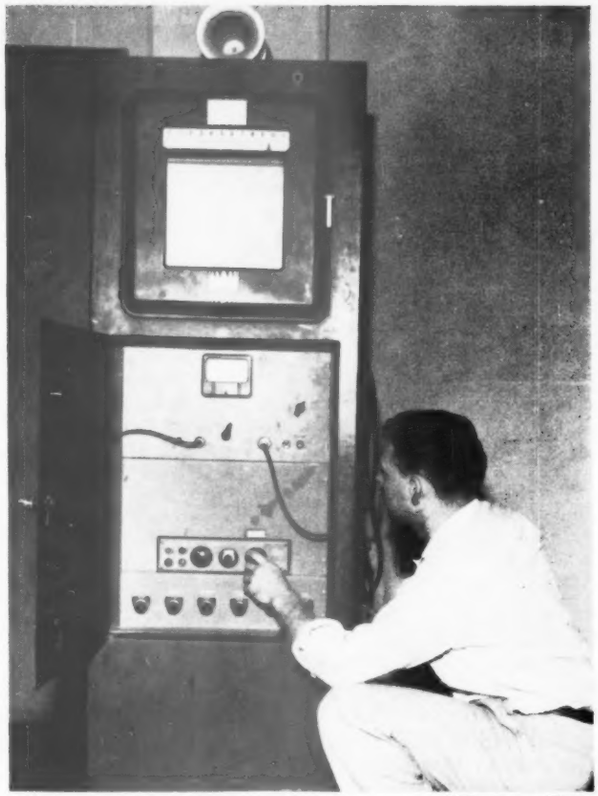
Military and industrial scientists and technicians met in Atlantic City for a four-day discussion of the increasingly greater problems caused by pollution of the atmosphere above cities and industrial areas. The Air Pollution Symposium was jointly sponsored by the U.S. Army Chemical Corps and the American Chemical Society, and was held in conjunction with the Society's 130th Annual National Meeting, September 17-21.

The Chemical Corps' interest in the air pollution problem stems from the fact that situations arising in this field are quite similar to those that would be encountered in an enemy attack with toxicological weapons upon the nation, especially in the area of detection.

The symposium covered four general areas: field studies of air pollutants; kinetics and related fundamental studies; biologic effects and techniques; and detection and analyses of air pollutants. Thirteen of the papers in the latter area were given by Chemical Corps' employees and contractors. Their remarks were based upon the work of the military in devising means to detect and analyze nerve gas and other toxic agents in the atmosphere.

An international aspect was given the symposium by the fact that Dr. Kingsley Kay of the Canadian Department of National Health, Oitawa, Canada, served with Dr. Solomon Love of the Chemical Corps' Chemical Warfare Laboratories, Army Chemical Center, Md., as co-chairman. Overall chairman of the symposium was Dr. Joseph W. E. Harrisson of the LaWall and Harrisson Research Laboratories, Philadelphia, Pa.

Group conferences were led by Dr. H. F. Johnstone of the Department of Chemistry, University of Illinois, Urbana, Illinois; Dr. A. J. Hagen-Smit of the California Institute of Technology, Pasadena, California; L. C. McCabe of Resources Research, Inc., Washington, D.C.; Richard D. Hoak of the Mellon Institute of Industrial Research, Pittsburgh, Pennsylvania; and P. W. Zimmerman of the Boyce Thompson Institute for Plant Research, Inc., Yonkers, New York.



—U.S. Army Photo

A civilian employe of the U. S. Army Chemical Corps adjusts the controls of an automatic gas alarm, being used in a building where there may be danger from escaping toxic chemicals. Such alarms, so delicate that they can detect the slightest trace of gas, have a similarity to equipment needed in air pollution control, and were among the items discussed during the four-day Air Pollution Symposium.

ARMED FORCES WRITER'S LEAGUE

The Armed Forces Writer's League, which was started in Hawaii about two years ago, announces it is now expanding its national organization. Branches are being established near most major military areas in the U.S. and overseas and there is also being offered a member-at-large status.

The League has as its special mission the promoting of writing and illustrating for publication by members of the Armed Forces and others associated with the Armed Forces. The membership charge is at one dollar a year. National President is Chief Petty Officer Robert L. Shirk, of Pearl Harbor. Inquiries should be addressed to National Secretary, LCDR Ray Ewing, Armed Forces Writer's League, 3542 No. Utah St., Arlington 7, Va.

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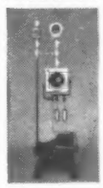

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THE CHEMICAL CORPS' PARTICIPATION IN THE FEDERAL CATALOGING PROGRAM

By LEO J. ARICO and DAVID A. ROSENFELD
Chemical Corps Engineering Command

Objectives: The Federal Cataloging Program is a Government enterprise to develop a single uniform catalog system by naming, describing, classifying, and numbering each item repetitively used, purchased, stocked or distributed by the Department of Defense or any of the departments thereof. The methods and procedures used in this program are designed to produce a single identification and Federal Stock Number for identical items within a bureau or service, between bureaus or services, or between the departments. It is primarily a tool for supply management, and its use is mandatory within the Department of Defense.

Background: The need for such a program has been recognized since 1914. Ensuing years, marked by two World Wars, the Korean incident, and an ever expanding peacetime Military Establishment have demonstrated the enormous costs to Government procurement resulting from the lack of a common language, universally understood and used throughout the supply systems of the military departments.

From 1914 through 1949, endeavors to accomplish this objective were initiated by the Navy, the Treasury Department, the Bureau of the Budget, and the General Services Administration. These efforts were authorized by Departmental Directives, Presidential Orders, or Federal legislation.

In 1952, the Congress enacted Public Law 436, The Defense Cataloging and Standardization Act, which provided for the establishment of the Defense Supply Management Agency. Unlike prior legislation, this bill recognized the close inter-relation of cataloging and standardization and provided for an Office of Cataloging, an Office of Standardization, and an Office of Inspection under the direction of the Defense Supply Management Agency.

With the reorganization of the Executive Branch of the Government in 1953, the Defense Supply Management Agency functions were transferred to the Office of the Assistant Secretary of Defense (Supply and Logistics), specifically to the Office of the Director, Cataloging, Standardization, and Inspection. In turn, cataloging responsibility was delegated to the Staff Director, Cataloging Division, Office of the Assistant Secretary of Defense.

The operation responsibility for the development of the Federal Catalog, within the Department of the Army, was assigned to the chiefs of the various technical services. This responsibility within the Chemical Corps is the mission of the Cataloging Division of the Chemical Corps Engineering Command.

Methods of Identification: To identify Chemical Corps items of supply in accordance with the program, two basic methods of item identification are utilized. These methods are known as the descriptive and the reference methods of item identification.

The descriptive method of item identification establishes and delimits the concept of an item of supply by the delineation of the essential characteristics of the item which give the item its unique character and serve to differentiate it from every other item of supply.

This type of item identification can be illustrated by its application to a chemical. Place the proper information around the chemical, such as grade, assay, physical form, specific impurities, specifications or standards data, package data, and the chemical is manually identified. More specifically, a chemical is identified as follows:

CHEMICAL: METHANOL, TECHNICAL
ASSAY: 99.0% min. assay as methanol.
DERIVATION: Synthetic or wood distillate.
SPECIFIC GRAVITY: 0.7939 sp. gr. at 20 deg./4 deg. C.
SPEC. DATA: Fed. Spec. O.M-232, Grade B.
PACKAGE DATA: 1 qt. bottle.

If you can put descriptive words around the item, you can process the descriptions manually. That is the descriptive side. Thus are description patterns developed, listings of the technical and physical characteristics unique to items of supply, permitting differentiation of one item from all others.

The reference method of item identification establishes and delimits the concept of an item of supply by reference(s) to the item identifying number(s) of one or more manufacturers, denoting the item or items of production included under the concept. Thus, under the reference method, the essential characteristics of the item of supply are not delineated in the item identification but are found by research of the drawings and other data represented by the manufacturers' item-identifying number(s).

This type of item identification can be illustrated by its application to a crankshaft, or blower housing. The essential characteristics are too involved to state in words so we identify the item by the reference method. The item is thus identified by reference to the manufacturer's number which gives access to complete manufacturer's data covering the item (i.e., drawings, catalogs, manuals, etc.).

Procedures: The Chemical Corps' participation in this program encompasses the progressive development of item names and description patterns. This development is accomplished through collaboration with all cataloging activities within the Department of Defense. The item names developed and approved are the names given to individual items, or to groups of items having the same characteristics, conveying a single concept of the items being identified. The names are then classified within a commodity structure known as the Federal Supply Classification. This commodity structure is presently composed of seventy-four groups; for example, FSC group 28, Engines, Turbines, and Components. These groups are in turn subdivided into approximately five hundred classes; for example, FSC Class 2805, Gasoline Reciprocating Engines, except Aircraft, and Components. Each class covers a relatively homogeneous area of commodities, in respect to their physical or performance characteristics, the relationship of parts, attachments, and accessories to the next higher assemblies for which they are specifically designed, or in the respect that the items included are such as are usually procured or issued together.

Following item name development and classification, description patterns are developed to permit descriptive type item identification. Item of supply may consist of "common" items or of items which are technically complex or of special design and function. The description patterns developed to cover these items must be correspondingly simple or complex to provide for a technically accurate description as well as a complete differentiation of like items. The item names and description patterns which are developed and approved are used throughout the Department of Defense.

During the development of item names and description patterns, all Chemical Corps items of supply are researched to determine their adaptability to one of the two methods of item identification. This research requires investigation of design characteristics as well as physical, performance, and logistics requirements. It includes screening of specifications, technical reports, manufacturers' catalogs, drawings, supply and technical manuals of the Military services, commercial and Military services, commercial and Military standards, and trade manuals and publications. It also involves coordination with responsible engineering personnel. Information assembled is then screened and evaluated and description patterns are prepared.

After determining the appropriate method of item identification, each Chemical Corps item of supply is described by using the applicable method.

The item identifications prepared by the descriptive method are then submitted to a cataloging activity designated as the Technical Reviewing Office. There they are screened against all other item identifications previously submitted under the same item name by other cataloging activities within the Department of Defense, to determine duplication or uniqueness. In addition to this screening, the item identifications are reviewed for technical and editorial accuracy. Upon the completion of this review, inaccurate item identifications are rejected and accurate item identifications are forwarded to the Cataloging Division, Office of the Assistant Secretary of Defense, for approval and the assignment of a nonsignificant seven-digit Federal Item Identification Number, which, coupled with the four-digit Federal Supply Classification Number, forms the Federal Stock Number. This procedure assures the assignment of a single Federal Stock Number to a single concept of an item of supply throughout the Department of Defense. An example of such a stock number is 2805-275-3037 (POWER UNIT, GASOLINE). This Federal Stock Number is recorded by publication and distribution of descriptive type item identifications by the Office of the Assistant Secretary of Defense.

The item identifications prepared by the reference method are forwarded to the Central Processing Office of the Cataloging Division on EAM (electrical accounting machine) cards. There they are screened against all other submissions by Department of Defense cataloging activities to determine duplication or uniqueness of the item of supply. If accepted as unique, the items are assigned Federal Stock Numbers and returned to the Chemical Corps. If an item is an apparent duplicate of an item previously submitted by other Department of Defense cataloging activities, it is assigned the same Federal Stock Number and returned to the Chemical Corps for verification and adoption.

In addition to submitting reference and descriptive type item identifications, each activity is responsible for the submittal of cross reference and interchangeability data, by means of EAM cards, to the Central Processing Office. Basically such data consist of activity stock number, manufacturer's data, Federal item name, and the like.

Between 14 November 1952 and 10 January 1955, the Chemical Corps was the designated Technical Reviewing Office for FSC Groups 68 (Chemicals and Chemical Products), and 96 (Ores, Minerals, and Their Primary Products), and FSC Class 1365 (Chemical Warfare Agents). The Technical Reviewing Office function was performed for the entire Department of Defense. Duties involved in accomplishing this function included technical and editorial review of item names, description patterns, and item identifications; resolution of controversial technical problems; screening of item identifications for duplication; and coordination of all collaboration required by the activities in the Department of Defense as a result of submissions of data to the Technical Reviewing Office. The above duties required the assembling of task group conferences for direct collaboration. During this period, the Chemical Corps processed to the Office of the Assistant Secretary of Defense approximately 3,500 item identifications, 1,700 item names, and 200 description patterns, which were approved and published.

Technical Reviewing Office responsibilities have been progressively assumed by the Cataloging Division of the Office of the Assistant Secretary of Defense. With the completion of this procedure the cataloging program will enter its maintenance phase.

Maintenance is that phase of the program wherein all data are kept current. As new items enter the Military Supply System, they are first screened against existing Federal data to determine whether or not they are duplicates of existing items of supply in the Federal

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Cataloging Program. If they are duplicates, the existing Federal data are adopted for the items of supply. In the event no duplication exists, further research is conducted to determine whether an existing item of supply can be adopted in lieu of the new item being considered. Army regulations direct designers to consider existing items of supply for inclusion in new equipment where practical in lieu of designing new and peculiar components. In the event a new item identification is necessary, existing item names and description patterns are scanned to determine their adequacy for the new item. If such item names and description patterns are inadequate, they are revised to include the new item or a new item name and description pattern is developed for the new item. Should the cross referencing and interchangeability file (EAM file) indicate, during this phase of the program, that there has been no known user of an established Federal Stock Number for a period of five years, that stock number will be cancelled by the Office of the Assistant Secretary of Defense.

The item identification data produced and promulgated under the Federal Cataloging Program within the Department of Defense will be used as rapidly as practicable in all supply operations to the exclusion of existing item identification data. Thus, the Federal names, descriptions, numbers and classifications will be the uniform language by which supply operations are performed within the Department of Defense. Conversion to and utilization of the item identification data will have effects on all personnel, organizations, functions, operations and records that are concerned with items of supply.

As each commodity area is declared to be in maintenance, Federal Catalog data covering the items in the area are disseminated for conversion and utilization purposes throughout the logistics system. These terms may be defined as follows:

Conversion is the operation whereby an activity's stock records, bin markings, procurement contracts, supply manuals, and the like are revised to reflect Federal catalog data in lieu of that activity's original identifying data. Utilization is the application of Federal catalog data to the exclusion of all former identifying data.

Benefits of the Program: Monetary savings will be realized as a result of the immediate and ultimate benefits to be gained by utilization of this program:

The following are the immediate benefits:

A common supply language is established and duplicate items are discovered and eliminated.

The interchange of supplies is facilitated.

Possible interchangeability is revealed and standardization is facilitated by Federal item identifications.

Maximum redistribution is effected and disposal is expedited, resulting in greater conservation of resources.

A basis is provided for uniform freight rates.

The following ultimate benefits will result:

Personnel needs will be reduced commensurate with reductions in inventories, storage space, and stock record-keeping requirements.

Bases will be provided for purchase assignments, evaluation of total requirements, industrial mobilization, and for preparation, justification, and comparison of budgets.

Government-industry relationships will be improved.

A foundation will be provided for uniform or integrated logistics systems.

The program is currently scheduled to enter the maintenance phase late in 1956. Conversion is scheduled for completion in 1957.

THE CHEMICAL CORPS ORGANIZATION

(Continued from page 19)

personnel, comprise Headquarters, Research and Development Command.

The Command includes three major Class II elements:

a. The BIOLOGICAL WARFARE LABORATORIES at Fort Detrick, Maryland, responsible for the Chemical Corps research and development in the biological field.

b. The CHEMICAL WARFARE LABORATORIES at Army Chemical Center, Maryland—responsible for the research and development program in the fields of chemical and radiological warfare (including flame and smoke).

c. The DUGWAY PROVING GROUND at Dugway, Utah—responsible for the Chemical Corps' research program in the fields of cloud physics and field testing methods and technology.

Materiel Command

The Materiel Command is responsible for the major functional areas of procurement, production, supply and industrial mobilization. The Headquarters of the Materiel Command is now located at Army Chemical Center, Maryland, and the Headquarters of that installation has been integrated into a single headquarters within that of the Materiel Command.

The Headquarters of the Materiel Command is responsible for the nationwide Chemical Corps activities in the major functional areas indicated above and, in addition, is responsible for the administrative and logistical support of all activities located at Army Chemical Center, including activities of other commands and of other services outside the Chemical Corps.

Engineering Command

The Engineering Command is a Class II activity of the Chief Chemical Officer under the direction and control of the Deputy Chief Chemical Officer for Scientific Activities. It is located at Army Chemical Center, Maryland, with a section located at Fort Detrick, Maryland, and in general is responsible for providing major essential engineering services to all members of the Chemical Corps. This new command is responsible for assuring that newly developed items are suitable for mass production methods, and that such items will require the least possible amount of critical materials. The Miller Committee advised that consolidation of all engineering into one organization would make available stronger specialized talents on all engineering problems.

Training Command

This command is under the technical supervision and operational control of the Assistant Chief Chemical Officer for Planning and Doctrine. It remains as previously constituted with the exception that the Doctrine Division has been eliminated, its functions having been incorporated into the Field Requirements Agency. The mission of the Training Command, a Class II activity, is to provide chemical, biological and radiological warfare training for troop units and individuals assigned to the Chemical Corps, and for selected individuals of the other components of the Department of Defense.

TIME FOR REFLECTION

By ROBERT E. HANNEMANN

TEN MONTHS AGO* I was discharged from the U.S. Army. At that time I entertained some rather indefinite ideas as to the value of my Army service. Since that time I have, with the help of a number of experiences, congealed these various ideas into several concrete thoughts. These thoughts are centered mainly about the Scientific and Professional Personnel Program since my entire service time was governed by its provisions.

I entered the Army in September of 1953 with the following background: a Bachelor of Science degree in Chemical Engineering, 13 months industrial experience, and enough pre-medical background to qualify me for acceptance in medical school. I was given the usual battery of aptitude and qualification tests at Fort Riley, Kansas and was classified as an SPP and sent to Fort Knox, Kentucky for basic training. I was assigned to Pine Bluff Arsenal, Arkansas. Upon reaching this post I was interviewed and accepted for work in what was then known as the X-201 plant, but which is now designated as The Production Development Laboratories of the Chemical Corps' biological warfare section. I was assigned, after a short wait for security clearance, to the Plant Manager's Office.

My first project was a process study which lasted for nearly ten months. I worked with another SPP, and we were jointly responsible for the complete investigation. This included everything from the original experimental studies of the process to the writing and editing of the final report and the revised standard operating procedure developed through the experimental work.

My second assignment was to organize a technical records system and office for The Production Laboratories. I was given an office to furnish and equip as I desired and was authorized to hire and train five civilian employees for the jobs of record supervisor and record clerks. During the nine-month period which followed this assignment, the Technical Records Office grew and developed to the point where nearly all plant records had been standardized, classified, and filed and were being made available to all divisions which needed them. The man who had been hired as the record supervisor had progressed to the point where he was able to perform his job with little or no supervision. I therefore felt justified in requesting an assignment which I felt would give me some experience which I would need the following year in medical school. This assignment was to the Laboratory Division. My request was granted, and my last two months in the Army were spent familiarizing myself with various types of laboratory equipment and procedures and getting accustomed to the type of scientific reading which I would be doing for medical classes.

On September 2, 1955 I was separated from the Army, and on September 18, 1955 I entered medical school. Being an engineer, things were very strange and new to me, but the many little things which I had done and observed in the laboratory at PDL helped me to feel more at ease.

On June 5, 1956 I completed the first year of medical school and began looking for a summer job as an engineer. Here again the experience gained at PDL helped me along. I was able to add nearly two years of engineering experience to my credit. I obtained a job in the engineering department of a large oil company and was given an additional salary compensation for both the Army time and the extra engineering experience.

I believe that the short history narrated above speaks for itself. I was discharged from the Army with considerably more valuable experience than I possessed when I was inducted. I also gained several of the so-called intangible benefits from my service. I felt that by using my engineering training and experience I was doing something worthwhile for my country. I could see the products of my efforts as tangible, living things. This was all made possible by the proper administration of the SPP program. This program, as often discussed in this magazine, is not perfect in itself, as many ex-SPP's will affirm.

During my stay at PDL I conducted an opinion survey among the SPP's stationed there. The majority of them were satisfied with their jobs and felt that they were receiving as well as giving something valuable by spending their service time in an SPP assignment. Their major complaint was that they were not given enough work to do. The supervisors for whom these SPP's worked were also interviewed and expressed themselves as being well satisfied with the performance of the SPP's under their supervision. Their major complaint was that the SPP's were spending too much time performing Army duties such as KP and CQ. It appeared at that time that the SPP's complaint concerning their light work load was coincident with their civilian supervisor's reluctance to assign work which they felt might be interrupted by the various Army duties. These duties held priority at PDL as elsewhere in the Army unless they seriously interferred with the SPP's work. In exceptional cases the SPP was relieved from such duties until his supervisor felt that he could be spared.

The SPP program as it existed 10 months ago was far from being ideal. Many SPP's felt that they gained nothing worthwhile from their duties. Possessing such attitudes, they also contributed very little to the mission of their specific installations. I feel, however, that such unfortunate experiences were the result of poor initial placement of the men or lack of proper utilization at the duty station rather than a basic fault in the program itself.

I believe that the basic idea behind all SPP-type programs—that of better utilization of scientific and professional men in the Army—is a worthwhile one from the Army's point of view. I also believe that my experience shows that it can be worthwhile from the individual's point of view. I know that I benefitted from my service under the SPP program, and I feel that, although my part in the overall mission of The Production Development Laboratories was a small one, it was, nevertheless, a significant one, and one of which I will always be proud.

*Space limitation prevented publication of this article in July as originally intended.—Ed.

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The Headquarters of the Materiel Command is responsible for the nationwide Chemical Corps activities in the major functional areas indicated above and, in addition, is responsible for the administrative and logistical support of all activities located at Army Chemical Center, including activities of other commands and of other services outside the Chemical Corps.

Engineering Command

The Engineering Command is a Class II activity of the Chief Chemical Officer under the direction and control of the Deputy Chief Chemical Officer for Scientific Activities. It is located at Army Chemical Center, Maryland, with a section located at Fort Detrick, Maryland, and in general is responsible for providing major essential engineering services to all members of the Chemical Corps. This new command is responsible for assuring that newly developed items are suitable for mass production methods, and that such items will require the least possible amount of critical materials. The Miller Committee advised that consolidation of all engineering into one organization would make available stronger specialized talents on all engineering problems.

Training Command

This command is under the technical supervision and operational control of the Assistant Chief Chemical Officer for Planning and Doctrine. It remains as previously constituted with the exception that the Doctrine Division has been eliminated, its functions having been incorporated into the Field Requirements Agency. The mission of the Training Command, a Class II activity, is to provide chemical, biological and radiological warfare training for troop units and individuals assigned to the Chemical Corps, and for selected individuals of the other components of the Department of Defense.

TIME FOR REFLECTION

By ROBERT E. HANNEMANN

TEN MONTHS AGO* I was discharged from the U.S. Army. At that time I entertained some rather indefinite ideas as to the value of my Army service. Since that time I have, with the help of a number of experiences, congealed these various ideas into several concrete thoughts. These thoughts are centered mainly about the Scientific and Professional Personnel Program since my entire service time was governed by its provisions.

I entered the Army in September of 1953 with the following background: a Bachelor of Science degree in Chemical Engineering, 13 months industrial experience, and enough pre-medical background to qualify me for acceptance in medical school. I was given the usual battery of aptitude and qualification tests at Fort Riley, Kansas and was classified as an SPP and sent to Fort Knox, Kentucky for basic training. I was assigned to Pine Bluff Arsenal, Arkansas. Upon reaching this post I was interviewed and accepted for work in what was then known as the X-201 plant, but which is now designated as The Production Development Laboratories of the Chemical Corps' biological warfare section. I was assigned, after a short wait for security clearance, to the Plant Manager's Office.

My first project was a process study which lasted for nearly ten months. I worked with another SPP, and we were jointly responsible for the complete investigation. This included everything from the original experimental studies of the process to the writing and editing of the final report and the revised standard operating procedure developed through the experimental work.

My second assignment was to organize a technical records system and office for The Production Laboratories. I was given an office to furnish and equip as I desired and was authorized to hire and train five civilian employees for the jobs of record supervisor and record clerks. During the nine-month period which followed this assignment, the Technical Records Office grew and developed to the point where nearly all plant records had been standardized, classified, and filed and were being made available to all divisions which needed them. The man who had been hired as the record supervisor had progressed to the point where he was able to perform his job with little or no supervision. I therefore felt justified in requesting an assignment which I felt would give me some experience which I would need the following year in medical school. This assignment was to the Laboratory Division. My request was granted, and my last two months in the Army were spent familiarizing myself with various types of laboratory equipment and procedures and getting accustomed to the type of scientific reading which I would be doing for medical classes.

On September 2, 1955 I was separated from the Army, and on September 18, 1955 I entered medical school. Being an engineer, things were very strange and new to me, but the many little things which I had done and observed in the laboratory at PDL helped me to feel more at ease.

On June 5, 1956 I completed the first year of medical school and began looking for a summer job as an engineer. Here again the experience gained at PDL helped me along. I was able to add nearly two years of engineering experience to my credit. I obtained a job in the engineering department of a large oil company and was given an additional salary compensation for both the Army time and the extra engineering experience.

I believe that the short history narrated above speaks for itself. I was discharged from the Army with considerably more valuable experience than I possessed when I was inducted. I also gained several of the so-called intangible benefits from my service. I felt that by using my engineering training and experience I was doing something worthwhile for my country. I could see the products of my efforts as tangible, living things. This was all made possible by the proper administration of the SPP program. This program, as often discussed in this magazine, is not perfect in itself, as many ex-SPP's will affirm.

During my stay at PDL I conducted an opinion survey among the SPP's stationed there. The majority of them were satisfied with their jobs and felt that they were receiving as well as giving something valuable by spending their service time in an SPP assignment. Their major complaint was that they were not given enough work to do. The supervisors for whom these SPP's worked were also interviewed and expressed themselves as being well satisfied with the performance of the SPP's under their supervision. Their major complaint was that the SPP's were spending too much time performing Army duties such as KP and CQ. It appeared at that time that the SPP's complaint concerning their light work load was coincident with their civilian supervisor's reluctance to assign work which they felt might be interrupted by the various Army duties. These duties held priority at PDL as elsewhere in the Army unless they seriously interferred with the SPP's work. In exceptional cases the SPP was relieved from such duties until his supervisor felt that he could be spared.

The SPP program as it existed 10 months ago was far from being ideal. Many SPP's felt that they gained nothing worthwhile from their duties. Possessing such attitudes, they also contributed very little to the mission of their specific installations. I feel, however, that such unfortunate experiences were the result of poor initial placement of the men or lack of proper utilization at the duty station rather than a basic fault in the program itself.

I believe that the basic idea behind all SPP-type programs—that of better utilization of scientific and professional men in the Army—is a worthwhile one from the Army's point of view. I also believe that my experience shows that it can be worthwhile from the individual's point of view. I know that I benefitted from my service under the SPP program, and I feel that, although my part in the overall mission of The Production Development Laboratories was a small one, it was, nevertheless, a significant one, and one of which I will always be proud.

*Space limitation prevented publication of this article in July as originally intended.—Ed.

SEEING ATOMS

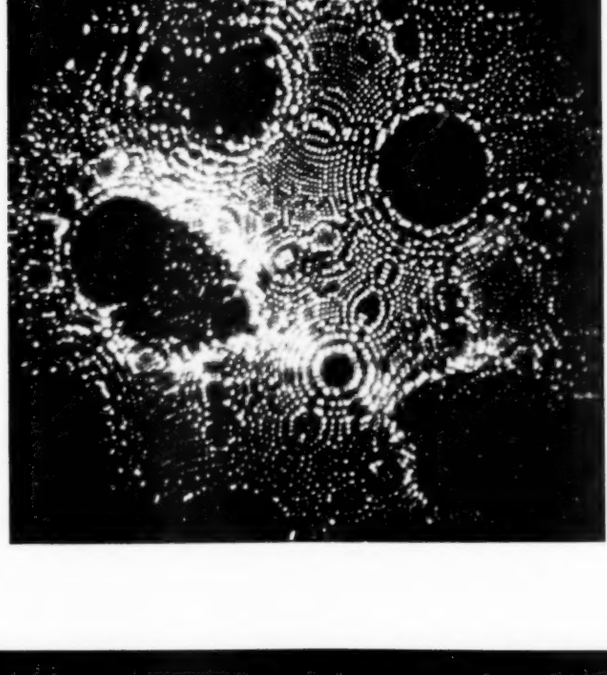
(Continued from page 13)

instrument, is already widely used in the laboratories of this country as the most sensitive tool for the investigation of mono-atomic adsorption layers on metal surfaces in connection with problems of ultra high vacuum techniques, catalysis and corrosion.

It is mainly the wave nature of the electrons that limits the resolution of the field electron microscope to about 20 Å, which is, by the way, also the practical limit of the conventional electron microscope with magnetic lenses. A major improvement seemed to be conceivable if it only were possible to use positive ions rather than electrons for the image formation. Ions, due to their larger mass, have a correspondingly shorter de Broglie wave length. Unfortunately, ions cannot be constantly supplied from the interior of the tip metal as it is done with electrons. This problem was solved by a simple trick. The field emission microscope is filled with a small amount of gas and then operated with the tip positive. Neutral gas atoms will approach the tip, and if the field strength is high enough, will be ionized at the surface. The ions then fly to the screen on the same paths as did the electrons. The probability of surface ionization depends on the geometrical fine structure of the surface, and hence the image on the screen will depict the tip surface. The author proved in 1951 that this field ion microscope actually works, and a resolution of about 6 Å was obtained with hydrogen ions.[2]

A MORE RECENT thorough investigation of this new effect of field ionization carried out at the Physics Department of the Pennsylvania State University under the sponsorship of the Air Research and Development Command yielded much information on important details of the image formation, which can be summarized here only briefly.[3] The ionization takes place some 5 to 10 Å above the surface, and mostly after the impinging neutral gas atoms have touched the tip surface and rebounded. The attraction of the gas atoms due to dipole forces in the field of the tip is of great importance, since the atoms pick up undesired energy on their approach.

Fig. 4. Ion image of a rhenium tip of 800 Å radius, taken at similar condtions as in Fig. 3. Large dark net plane close to center at upper right is a 10$\bar{1}$0 plane. Many high index planes are resolved in single atoms.



Dr. E. W. Müller is a native of Berlin, Germany, where he received his Ph.D. in Physics. Working on field emission research before the war he invented the field emission microscope. During World War II he was engaged in research on gaseous discharges. Later he became division chief at the former Kaiser-Wilhelm-Institute in Berlin, now the Max-Planck-Institute for Physical Chemistry, and he was also Professor of Physics at the Free University of West Berlin. In 1952 he was appointed Professor of Physics at the Pennsylvania State University, where he is presently engaged in field emission research under the sponsorship of the Air Research and Development Command.

This leads to a blurring of the image by the conservation of the lateral velocity component after ionization. Fortunately the rebound atoms can be slowed down by reducing the tip temperature. Operating the microscope with helium or neon and with the tip cooled to liquid hydrogen temperature finally yields the optimum resolution.[4] A typical design of the microscope is shown in Fig. 2. The tip is cooled by heat conduction through the leads from the central glass tube that contains liquid hydrogen. The image, which appears about as weak as the milky way in the sky, is photographed from below by a special f:1 camera on ultra sensitive film in an exposure time from one minute to one hour, and the visual observation through a magnifying glass is extremely eye-straining.

A typical photograph is represented in Fig. 3. It encompasses the central part, about one quarter of a hemispherical tungsten tip of 1,000 Å radius. Each fine white dot is an image of an individual atom. The symmetric pattern is due to the crystalline structure of the whole tip, in which the tungsten atoms are regularly arranged at the corners and in the center of tiny cubes of 3.16 Å size. Fig. 4 is a similar picture of a rhenium tip of 800 Å radius. Rhenium has a hexagonal closed packed lattice. The large areas are closely packed net planes whose atoms are not depicted. Actually one sees the atoms along the concentric edges of the net planes of increasing diameter. If the atoms protrude somewhat more from the surface, they will appear brighter and larger. From this it is possible to draw conclusions about imperfections in the regular lattice arrangement.

THE STUDY of imperfections and dislocations which are of paramount significance for the strength and corrosion properties of metals, is one of the main objectives of the present research. It is possible to observe the motion of the dislocations under the mechanical stress exerted by the electrical field (up to a 2 million lbs. per square inch). These high forces somewhat limit the applicability of the new microscope in its present form to the refractory metals. So far, experiments have been made with tungsten, rhenium, tantalum and molybdenum, and probably a few more metals might be accessible. But even so there is a wide field of the unknown to be studied. Manipulation of these fine specimen, perfectly polished tips with radii from 200 to 1,000 Å can be made by ion bombardment, by condensation of alike or similar metal vapors on the tip in the amount of a few atoms, by adsorption of oxygen, and by field evaporation. The latter is a newly discovered effect,[5] consisting of the evaporation of the tip metal by the ap-

(Continued on page 38)

OLIN MATHIESON

(Continued from page 17)

Mathieson's third plant, at Lake Charles, Louisiana, began operations in 1934. The Lake Charles site, only a few miles from the Gulf of Mexico, was attractive because of the availability of natural gas for fuel, good transportation, an ample supply of salt, and large beds of oyster shells for lime. This plant today is one of the largest alkali producers in the South, and is also a large producer of ammonia.

Mathieson in World War II

Again, in World War II, chlorine and alkali chemicals became urgently needed for the defense effort. Chlorine was used directly by the Armed Forces for water purification and sanitation, and indirectly for the defense by various war industries. Mathieson HTH (calcium hypochlorite) was used extensively for water purification and sanitation in the field. A subsidiary company manufactured glass ampules containing a small amount of HTH which were used to purify water in canteens.

Chlorine was in greater demand for war production than any other industrial chemical. It was required in the making of high octane gasoline for planes and tanks; in making diethylene glycol used as the cooling agent in high-speed liquid-cooled engines; in chlorinated paraffins, used in lubricants; in trichlorethylene, a degreasing solvent for plane engines and parts; in plastics used for cowlings and cockpit covers for warplanes and for insulating the famous degaussing cables used to protect ships from magnetic mines; in insecticides for field protection of troops; in the production of smokeless powder and other explosives; in synthetic rubber for barrage ballons and other wartime uses; in carbon tetrachloride for fire extinguishers for tanks, planes and trucks and in processing textile fabrics of all kinds for the Armed Forces.

Other Mathieson chemicals, while not so spectacular as chlorine in their war uses, played an essential part in the production of iron and steel, aluminum, plastics, explosives, rubber (and rubber reclaiming), gasoline, lubricants, textiles, paper, food and medical supplies. Ammonia, in particular, was produced at Lake Charles, Louisiana for the government.

Mathieson's contributions to defense did not end with World War II. Based on disclosure in 1954 of the successful German use of hydrazine as a rocket fuel, the company embarked on an intensive research program on this product which resulted in important improvements in the method of manufacture and the first successful commercial production of anhydrous (water-free) hydrazine. A pilot plant was built first at Niagara Falls, New York, and a full-scale plant later at Lake Charles, Louisiana. Because of its high energy per unit weight, hydrazine and several of its derivatives are of interest as propellants for aircraft and long-range missiles. Hydrazine has since proved to have uses in making a number of commercial products as well.

Mathieson Expands

By the time of the second World War, Mathieson with its three plants in Saltville, Niagara Falls, and Lake Charles, was doing a substantial share of the alkali business of the country, and its products enjoyed an excellent reputation. But it was participating to only a limited extent in the major expansion of the chemical industry which had been going on for a decade or more and was to be greatly accelerated during and following the war. A change in course was due.

In 1948 under the leadership of President Thomas S. Nichols, the company embarked on a vigorous and forward-looking program to take advantage of the growing market for chemicals. By modernizing existing facilities and constructing new ones, it was able in a short time to attain a more substantial position in basic inorganic chemicals. Through acquisition it obtained a major place in agricultural chemicals and in the drug manufacturing industry. In entering the agricultural chemicals field, Mathieson became at the same time a major producer of sulfuric acid. Through additional internal expansion, it established an organic chemicals operation and added to its position as a principal producer of fertilizers and pesticides.

Enters the Fertilizer Industry

Mathieson had supplied the fertilizer industry with ammonia for some time. Early in 1949 Mathieson became a producer of agricultural chemicals itself through acquisition of the Standard Wholesale Phosphate and Acid Works, Inc., operating on the Eastern seaboard with headquarters in Baltimore, and the Southern Acid and Sulphur Company, operating in the Southwest and Gulf Coast areas. These two long-established companies made sulfuric acid, processed sulfur, and fertilizers, and were consumers of ammonia. Shortly after Mathieson advanced its interest into the essential area of plant foods, it pioneered high analysis fertilizer to give the farmer this much needed aid and reduce to a minimum his handling of inert materials. The capacity of the newly acquired Pasadena, Texas, fertilizer plant was advanced from 425 tons to over 1,000 tons per day of high analysis plant foods.

During World War II, the Pasadena Plant had been built to help produce the additional food needed in this country and overseas. Sulfuric acid, always one of the most important of industrial chemicals, was more important than ever to the War effort.

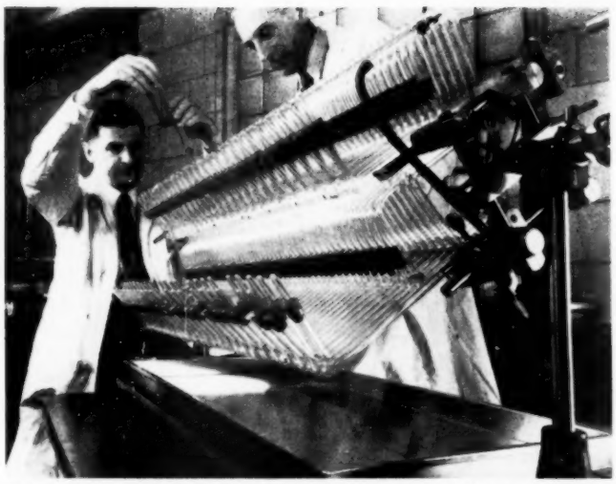
To extend its distribution of agricultural chemicals into the far West, Mathieson in 1952 acquired the fertilizer division of the Tovrea Land and Cattle Company, near Phoenix, Arizona. Later that year the company acquired the North Little Rock, Arkansas, warehouse facilities of Temple Cotton Oil Company and also the Activated Alum Corporation of Baltimore, manufacturer of aluminum sulfate, used in water purification and sewage treatment.

Insecticides are a natural adjunct to the distribution of agricultural fertilizers. To this end, John Powell and Company, a leader in the development and formulation of pesticides, was acquired in 1953, and in 1954, the Calabama Chemical Corporation, of Huntsville, Alabama, a manufacturer of DDT, was integrated into Mathieson's insecticides business. In 1955, in order to further expand its production and distribution facilities in this area, Olin Mathieson acquired several additional insecticide manufacturing plants.

In order to obtain the maximum benefit from fertilizers, agricultural crops need an ample supply of water. Therefore, Mathieson began to encourage the use of irrigation by farmers. To further aid them, the company started to manufacture and distribute its own irrigation equipment, designing special systems, and advising farmers on particular problems.

Petrochemicals—More Diversification

In 1950, the company took a major step toward diversification in another direction with its entry into petrochemicals. Tapping into one of the transcontinental natural gas pipelines for its raw material, Mathieson built a multimillion-dollar petrochemicals plant at Branden-



Using Craig Counter Current Apparatus at Squibb Institute for Research, New Brunswick, New Jersey. Research has been important to the Squibb organization ever since Dr. E. R. Squibb set up his own laboratory in 1858, then went on to discover the first pure and reliable ether. Today the Squibb Division of Olin Mathieson is a major producer of ethical drugs.

burg, Kentucky, close to midwest and north central markets. This plant is now a major producer of ethylene oxide, ethylene glycol and other ethylene derivatives with a variety of uses in industry. Ethylene glycol is the principal ingredient in permanent type anti-freeze. Since Mathieson also produces methanol, used in another type of anti-freeze, it became a major supplier to the anti-freeze industry.

To secure its position in this industry, Mathieson in 1953 acquired Puritan Company, Inc., of Rochester, New York, and its operating subsidiary, Genesee Research Corporation, packagers of private label anti-freeze preparations, hydraulic fluid, automotive specialties, surgical soap preparations, and certain special organic chemicals. In addition, Mathieson acquired the anti-freeze marketing business of U. S. Industrial Chemicals, Inc., and the famed "Pyro" anti-freeze trade names.

About the same time that the petrochemicals plant was built, a new chlorine-alkali unit was added at Saltville, Virginia, to supply chlorine for this facility. In 1951 Mathieson's third chlorine and caustic soda plant was built near Mobile, Alabama, on the huge McIntosh salt dome to serve the needs of the paper plants and other new industries then being established in the middle South. Like the Brandenburg petrochemicals plant, this plant is located near major consumers of its products.

SQUIBB JOINS MATHIESON

Falling into line with Mathieson's basic planning to produce or sell chemicals or products essential to mankind, the year 1952 brought still another opportunity to move into new fields through a merger with E. R. Squibb & Sons, one of the world's leading and most highly respected drug and pharmaceutical houses, founded in 1858. Through Squibb, Mathieson obtained a firmly established position in the drug manufacturing field and also in household necessities. Squibb further brought with it a complete international sales organization and overseas production plants as well.

Dr. Squibb and The Navy

Dr. Edward Robinson Squibb, founder of the Squibb Company, had been an Assistant Surgeon in the Navy during the Mexican War. During this period, he became aware of the untrustworthy nature of the medicines used. There were no legal pharmacopoeal standards as we understand them today, and drugs were vaguely designated according to their vegetable or mineral origin. Standards of potency didn't exist—and three ounces of a given drug from one lot might not be equal to half an ounce from another lot.

Pure Drug Standards

After the war, Dr. Squibb was assigned to shore duty at the Brooklyn Navy Yard, and he began agitation for pure-drug standards. Finally, in 1852, Congress appropriated limited funds to establish a naval laboratory for drug research, and in a small room above the morgue in the Naval Hospital, Dr. Squibb went to work, with equipment of his own design, and some of it of his own construction. He tested, assayed, and standardized a wide variety of drugs used by the Navy. Since there were no prior standards of purity and efficacy, Dr. Squibb established his own, and no higher ones could have been set up at that time. As a final check and guarantee, Dr. Squibb personally signed the labels on all products he had made or tested, and his signature soon became famous throughout the Navy.

In 1857, the Chief Medical Purveyor of the U. S. Army proposed that Dr. Squibb establish his own laboratories. If he would open his own private laboratory, with private capital, the Army would buy the bulk of his output, and he would find a ready market for the remainder among hospitals and civilian doctors. Resigning from the Navy, Dr. Squibb did just that. Shortly after, at the time of the outbreak of the Civil War, Squibb was in a position to meet many of the needs of the Army.

Early in his career, Dr. Squibb succeeded in producing the first pure, uniform anesthetic ether. It was the world's first reliable anesthetic of any kind. Today the Squibb Division of Olin Mathieson manufactures a major share of the ether used in U. S. hospitals. Ether has been of immeasurable importance to surgery for almost a hundred years for both military and civilian uses.

Squibb in World War II

In World War I, World War II, and the Korean War, Squibb drugs helped our fighting men combat disease

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and infection and save uncounted lives. Squibb antibiotics and blood plasma derivatives were of great importance on the battlefield. In World War II, Squibb manufactured 159 different products for military use, including such items as sulfa drugs, gas gangrene antitoxin, typhus vaccines, blood serum albumin, anesthetics, glandular products, and vitamins. The Squibb laboratories also conducted important research and development work for the Armed Forces in the fields of antimalarials, microbiotic agents useful in combating blood and bone infection, new sulfonamides and new biologicals.

Squibb was one of the first quantity-manufacturers of penicillin in this country. Some of its more recent significant products are Mycostatin, an anti-fungal antibiotic, and Mysteclin, a broad-spectrum antibiotic which kills both bacteria and secondary fungus growths. Today the Squibb Division of Olin Mathieson spends many million dollars every year on research to develop new products which will be useful to both the Armed Forces and the civilian population.

In 1952 Mathieson broadened its ammonia manufacturing interests to the Morgantown Ordnance Works at Morgantown, West Virginia, one of the largest ammonia plants in the country. This plant, which is currently being modernized, and which has been operated on lease from the United States Government, also produces methanol, formaldehyde, hexamine, and other products.

THE MERGER OF OLIN AND MATHIESON

By 1954, Olin Industries, Inc., and Mathieson Chemical Corporation had each progressed to about the same point. Each had annual sales in the neighborhood of $240 million, and their histories of growth and diversification were similar. The two managements recognized that each company had a contribution to make to the other which would result in a stronger, better-balanced organization with greater opportunities for customers, stockholders, and employees. In August, 1954, the two companies merged to form Olin Mathieson Chemical Corporation.

Because of its interest in rocket propellants, Mathieson had acquired in 1954 a 50 per cent interest in Reaction Motors, Inc., of Denville, New Jersey, a leader in the development and manufacture of liquid-fuel rocket engines. After the merger of Olin and Mathieson, the combined company increased this participation in the aviation field through acquisition of a part interest in Marquardt Aircraft Company of Van Nuys, California, the West's largest jet engine research and development center and pioneer in the ramjet engine field.

Within the year after the merger, Olin Mathieson acquired a substantial interest in Hunter Engineering Company, with a research and development plant on the west coast. Olin Mathieson's goal there is to develop and perfect new methods and fabrication processes upon which to expand its light metal fabrication facilities.

The Corporation had already expanded its interest in the area of metals fabrication by developing "ROLL-BOND," a unique process for turning out, on a production line basis, any desired pattern of tubing in a homogeneous sheet of metal. Then, in 1955, Olin Mathieson acquired Mississippi Aluminum Company, of Gulfport, Mississippi, and thereby became a producer of a variety of aluminum extrusions for the construction industry and agriculture. Among these products are irrigation pipe, which is marketed through the Corporation's agricultural sales outlets, and standard commercial extrusions for home and building construction.

Broadening in Chemicals and Paper

The new corporation's chemical interests were further diversified when in 1955 it acquired the Blockson Chemical Company, of Joliet, Illinois, a manufacturer of sodium phosphates, used largely in the soap and detergent industries. The addition of Blockson put Olin Mathieson into still another branch of the chemical industry and provided it with facilities whereby it will be able to pursue developments in phosphorus chemistry and phosphoric acid.

Also in 1955, Olin Mathieson purchased the Brown Paper Mill Company, Inc., of West Monroe, Louisiana. This transaction included a pulp mill and four associated manufacturing plants producing kraft paper, paper bags, and paperboard boxes. This addition blended well with the company's already existing activities in forest products, paper and cellophane. The operations of Brown Paper Mill Company, Inc., have been integrated with the company's Forest Products Division.

Entering the Primary Aluminum Industry

Plans of several years standing came to fruition when the Corporation announced in January, 1956, that it planned to construct a primary aluminum facility near Clarington, Ohio, with completion expected in 1958. More recently it was announced that Olin Mathieson and Revere Copper and Brass, Inc., have formed a jointly owned $231 million company, Olin Revere Metals Corporation, to produce 180,000 tons a year of primary aluminum at Clarington. In addition, an alumina plant with a capacity of 350,000 tons per year will be built at Burnside, Louisiana, on deep water transportation. Olin Revere will also own two thirds of a power plant at Cresap, West Virginia, to supply the power needs at the Clarington plant. An aluminum rolling mill will be constructed by Olin Mathieson near the Clarington site.

Olin Mathieson Today and National Defense

With the creation of its Aviation Division in 1956, the company took a significant step further into the area of production for defense. With the receipt from the Department of Defense of a contract to build a $36 million plant near Niagara Falls, New York, the company will produce a new high energy chemical fuel for use in missiles and aircraft engines. Additional new activity in the defense area was the formation early this year of a Nuclear Fuel Division. This division will produce nuclear fuel elements and nuclear reactor cores.

Tied in closely with Olin Mathieson's Aviation Division activities is a joint research and development program with Marquardt Aircraft and Reaction Motors to advance the science and practical applications of supersonic propulsion and related fields, primarily in the interest of defense. Known as the "OMAR" program, this effort embraces the fields of advance rocket and ramjet engine design, improved rocket engine propellants, and special mechanical and engineering processes. The program draws upon the specialized research, engineering and development resources of the three organizations.

In addition, Olin Mathieson is currently active in other defense areas. The company manufactures explosives and detonators and is the supplier of Olin Ball Powder for small arms. (The Winchester .308 cartridge, using Olin Ball Powder, is the standard cartridge of the NATO defense forces.) A jet engine starter cartridge is currently in production at one of the company's plants, using a solid propellant charge. The Corporation also operates for the United States Government the Badger Ordnance Works at Baraboo, Wisconsin; the Wabash River Ordnance Works at Newport, Indiana; the Alabama Ordnance Works, at Childersburg, Alabama; and the U. S. Defense Corporation plant at St. Louis, Missouri.

THE CHEMICAL CORPS AND BODY ARMOR

By GEORGE B. COE

First Lieutenant, Chemical Corps
Directorate of Medical Research
Chemical Warfare Laboratories
Army Chemical Center, Maryland

PRIOR TO AND WITH the advent of the Korean conflict, the Biophysics Division of the Chemical Corps Medical Laboratories had conducted research on the effectiveness of various types of armor material that might prove suitable for fabrication into a protective vest (1), (2). The first material tested was 0.080-in. thick Hadfield steel. It was determined that it was not feasible to incorporate such a material into a vest due to its weight; therefore, other materials were then tested in the same manner employing ballistic data received from Aberdeen Proving Ground and Watertown Arsenal, Watertown, Mass. Materials used in tests conducted by these laboratories that did prove feasible were nylon and fiber glass (Doron).

With the opening of hostilities in Korea, it was realized that it was important to obtain all available data on casualties. The Biophysics Division, Chemical Corps Medical Laboratories, consulted with the Chairman, Medical Research and Development Board, Office of the Surgeon General, on this need. The Surgeon General organized a wound ballistics research team which, with the approval of the Commanding General, Research and Engineering Command, operated from the Wound Ballistics Laboratory as its home base from whence it was dispatched to Korea. The objects of this survey were to determine: (1) Type of wounds our casualties were receiving, (2) type missiles causing these wounds, (3) regional and area frequency of wounds, and (4) single versus multiple woundings. Results of this survey on wounded in action are as follows:

Regional Frequency of Wounds		Body Surface Area
Head	16.4%	12%
Thorax	7.9%	16%
Abdomen	6.2%	11%
Upper Extremities	25.0%	22%
Lower Extremities	43.7%	39%
Genitalia	0.8%	

Type Wounds	
Penetrating	73.0%
Perforating	21.0%
Lacerating	4.0%
Amputation (Traumatic)	1.0%
Avulsion	0.7%
Contusion	0.6%

Wounding Missiles	
Fragments	91.9%
Small Arms	7.5%
Other	0.6%

Single vs. Multiple Woundings	
Single Wounds	35%
Multiple Wounds	65%

Fragments were responsible for 92% of all wounds in our wounded in action. Seventy-three per cent of all wounds were penetrating (entrance but no exit). This suggested that most of the wounding fragments were of comparatively low velocity. Based upon this information, the team recommended that a lightweight vest covering the thoraco-abdominal regions be field tested in Korea. Accordingly, in cooperation with the Medical Research and Development Board, Office of the Surgeon General, the Naval Field Medical Research Laboratory, Camp Lejeune, North Carolina, and the Research and Development Division, Naval Bureau of Medicine and Surgery, Washington, D.C., a joint Army-Navy mission was organized for the purpose of field testing a combination nylon-doron vest under actual combat conditions. This vest had been designed by the Navy but was modified by the Army prior to its fabrication. In June 1951 the team departed for Korea. Results of this trial confirmed the wound ballistics team recommendations. Above all things, the soldiers and marines in Korea wanted a vest that would be compatible with their other equipment and would stop missiles of medium and low velocity. A typical comment which came from these men who were wearing the vest even during these hot summer months was, "I would rather wipe sweat than blood."

Prior to the introduction of body armor on a large scale, a wound ballistics team including personnel from the Biophysics Division was sent to the Graves Registration Service Group, Kokura, Japan for the purpose of establishing the regional frequency of lethal wounds and type missiles causing these wounds in United States soldiers, killed in action. Results of this survey yielded the following information:

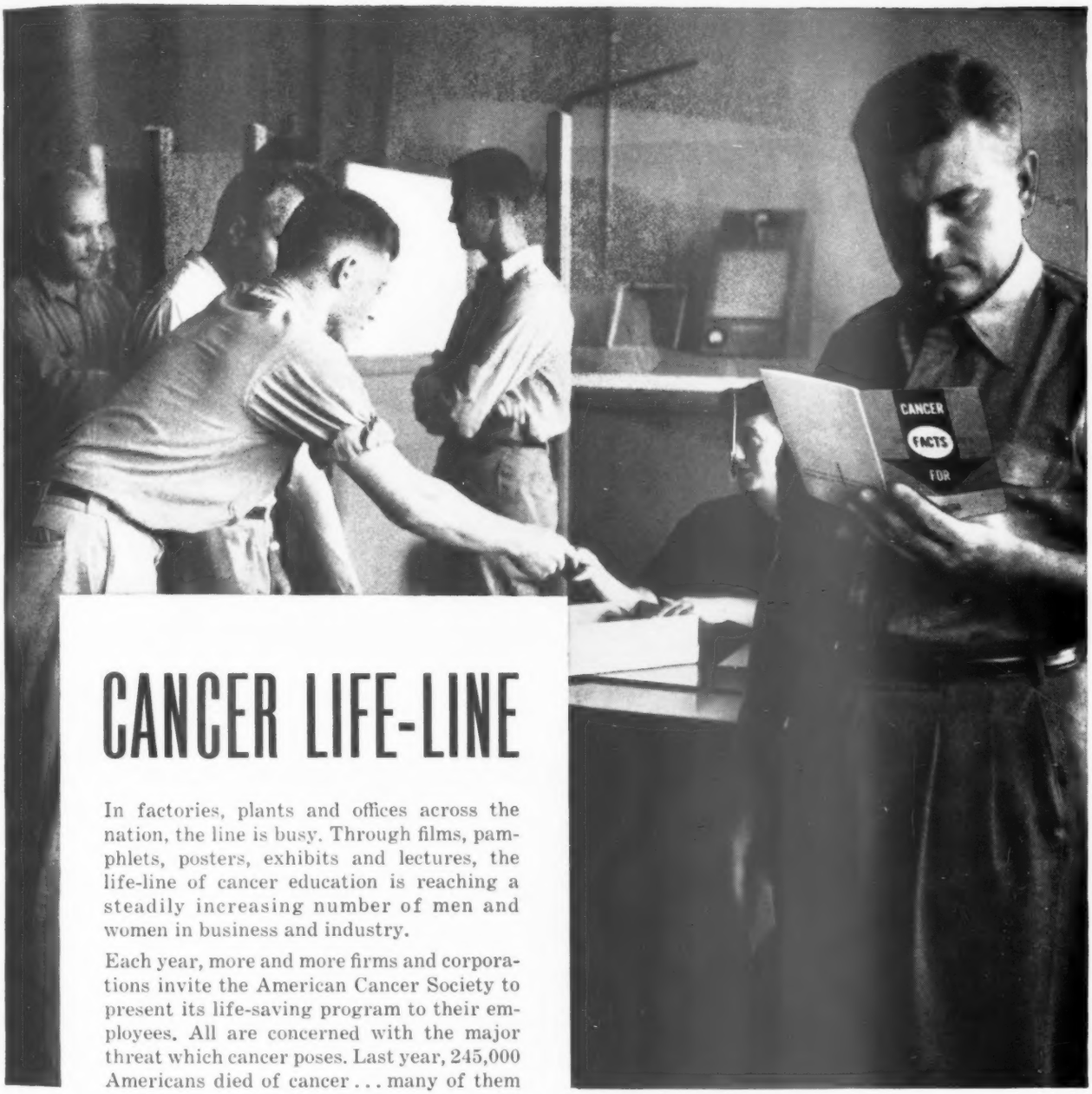
Region	% Lethal Wounds
Head	12.1
Neck	5.3
Thorax	58.2
Abdomen	13.3
Upper Extremities	2.4
Lower Extremities	8.7

After the introduction of body armor and when all front line troops were equipped with the vest, a similar survey was accomplished to determine the reduction of lethal wounds in those regions receiving the protection. Results of this survey were as follows:

Region	% Lethal Wounds
Head	41.4
Neck	14.4
Thorax	22.2
Abdomen	8.2
Upper Extremities	2.6
Lower Extremities	11.2

The reduction of 36% in lethal wounds occurring in the thoracic region and the 5.1% reduction in the abdominal region shows clearly the effect body armor has had on the number of killed in action who die of lethal

(Continued on page 40)



CANCER LIFE-LINE

In factories, plants and offices across the nation, the line is busy. Through films, pamphlets, posters, exhibits and lectures, the life-line of cancer education is reaching a steadily increasing number of men and women in business and industry.

Each year, more and more firms and corporations invite the American Cancer Society to present its life-saving program to their employees. All are concerned with the major threat which cancer poses. Last year, 245,000 Americans died of cancer . . . many of them needlessly. Among them were experienced executives, key officials, skilled workers. Their loss to business was incalculable. The greater loss, in terms of personal tragedy, was appalling.

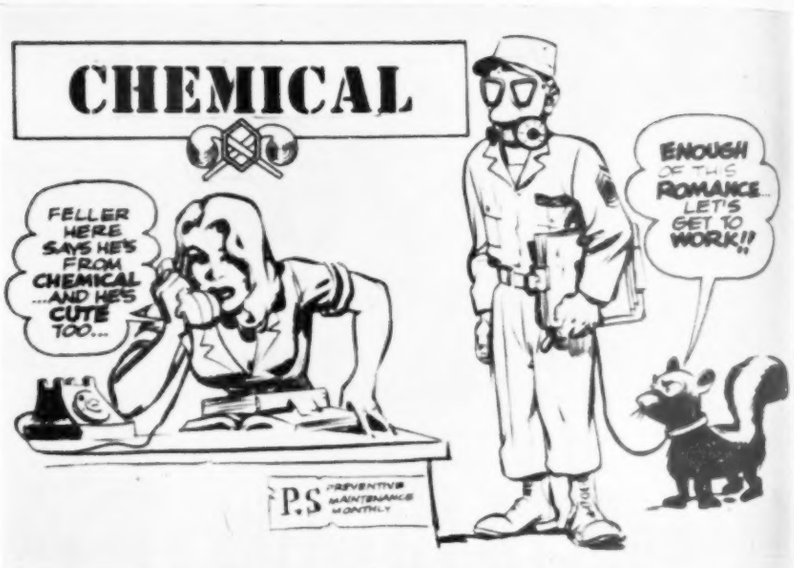
Yet, thousands and thousands of them could have been saved *if they had known the importance of going to their doctors in time.* Early detection plus prompt treatment could literally mean the difference between life and death. This, and many other facts of life about cancer, are part of the education program which the American Cancer Society offers you – in your plant or factory. For additional information, call the American Cancer Society office nearest you, or write to "Cancer" in care of your local Post Office.

AMERICAN CANCER SOCIETY

CHEMICAL CORPS NEWS

BLOND BEAUTY "CONNIE RODD" TAKES OVER "PREVENTIVE MAINTENANCE" PROBLEMS FOR CML. CORPS

The Chemical Corps has recently joined with three other services—Engineers, Ordnance, Quartermaster—in actively supporting the publication by the Army of a monthly magazine devoted to "Preventive Mainenance" in connection with the use and storage of military equipment. The title of the magazine is "PS," which stands for 'Postscript,' meaning something in addition or supplementary to official publications.


CHEMICAL
FELLER HERE SAYS HE'S FROM CHEMICAL ...AND HE'S CUTE TOO...
ENOUGH OF THIS ROMANCE... LET'S GET TO WORK!!
P.S PREVENTIVE MAINTENANCE MONTHLY

The above illustration in color heads up the new Chemical section in issue No. 48, published in September, of "PS," the Army "preventive maintenance" magazine.

PS aims to appeal especially to troops charged with maintenance duties and operation of military equipment. The pocket-size magazine is printed in color, extensively illustrated and makes use of "comic-strip" techniques to arouse interest. Maintenance problems submitted by soldiers in the field are processed as necessary for authoritative study and solution and are then dealt with in special articles under the by-lines of appropriate "staff experts." These include several fictional characters. To quote from a PS release: "M/Sgt. Half-Mast McCanick is the Ordnance expert. He's probably forgotten more maintenance gimmicks than most men learn in a lifetime. M/Sgt. Dozer, a husky sort of fellow, is on the receiving end of the Engineer letters. Beautiful, blond Connie Rodd, a classy lass with torsion bar suspension, takes over for the Chemical and Quartermaster sections."

Issue No. 48 of the magazine which came out in September contains the first presentation about Chemical Corps items. We learn that the collective protector has been renamed "Filter Unit, Gas-Particulate"; there are also items about smoke generator and flame-thrower upkeep.

In a letter announcing the Chemical Corps' participation in the program, Major General William M. Creasy, Chief Chemical Officer, states, in regard to Chemical Corps maintenance problems: "I ask that every military man contribute."

The publication originated with the Ordnance Corps in 1951 and is produced under contract and distributed (173,000 each month) by the Office of the Adjutant General. The editorial and business office of the publication is at Raritan Arsenal, Metuchen, N.J.

30,000 MILES FOR HIS DEGREE

Dr. Marvin A. Stolberg, chemist at the Army Chemical Center, Md., traveled 30,000 miles to receive his Ph.D. degree from the University of Delaware. This travel—240 miles in two round trips a week from his home in Baltimore to the University at Newark, Del., with stopovers for a day's work at the Center, of course—took four years. It terminated on June 3 when Dr. Stolberg received his Ph.D. He was never late for class.

LIQUID COATING FOR AUTO TIRES

A Department of the Army announcement states that the Chemical Corps, in its continuous battling to reduce costs, has developed a means of protecting automobile tires from deterioration when vehicles are placed in storage. This is a liquid coating of adhering plastic containing aluminum pigment which can be sprayed or brushed on the tire. It dries rapidly, is olive drab in color and can be quickly stripped from the tires when vehicles are placed back in service. The preservative prevents cracking, excessive drying and scaling, thus reducing the likelihood of blowouts.

RECEPTION FOR GEN. ROTHSCHILD

Pictured above at the Chemical Corps reception in honor of Brig. Gen. Jacquard H. Rothschild, Commanding General of the Corps Research and Development Command, held at the Naval Gun Factory, Washington, D.C., July 13, left to right: Major General William M. Creasy, Chief Chemical Officer; Mrs. Rothschild; General Rothschild; Mrs. Creasy.

WEST POINT CADETS GIVEN CBR TRAINING

U.S. Army Photo

Capt. Franklin P. Shoenberger, The Chemical Corps School, Ft. McClellan, Ala., uses a cadet to demonstrate the proper adjustment of the gas mask during the CBR course of instruction at the United States Military Academy this summer.

WEST POINT, N.Y.—Modern concepts of chemical, biological and radiological warfare were outlined for cadets of the Third Class (Sophomores) at the United States Military Academy, by an 8-man team of experts from the Chemical Corps Training Command, Ft. McClellan, Ala., during the summer training cycle. The team was headed by Colonel C. H. Wood, Assistant Commandant at the Chemical Corps School at Ft. McClellan.

Cadets received the latest information on agents and munitions and the methods of protection against chemical and biological warfare. Interspersed demonstrations of chemical munitions added visual experience to lecture theory.

Each year Third Classmen of the Academy complete an intensive seven-week summer training cycle in the field. During this period, the cadets are introduced to the basic operations of the various branches of the Army.

HIGH SCHOOL BOYS TOUR DUGWAY PROVING GROUND

Mr. Donald Shearer (right) of the Chemical Corps' Dugway Proving Ground Meteorological division, explains the use of the profile weather mast and how it measures wind velocity and temperature for test purposes to a group of Tooele, Utah, High School science students during their tour of the post. Talks were also given by Mr. Richard Caskinetti, (left) of the weather division.

DUGWAY PROVING GROUND, UTAH—A tour of the Chemical Corps technical laboratories and post facilities was made recently by a group of 27 Tooele, Utah, High School senior boys, who are enrolled in science classes.

The tour was arranged for the boys following an invitation extended by Colonel Donald D. Bodé, post commander. The Salt Lake City School system has been invited to arrange similar tours for students interested in scientific careers.

NEW DIRECTOR FOR CORPS SUPPLY AND PROCUREMENT

EDGEWOOD, MD.—Lt. Colonel James A. Richardson has been appointed Director for Supply and Procurement, Headquarters, Army Chemical Center and Chemical Corps Materiel Command. This position, formerly held by Colonel Claude J. Merrill, now Deputy Chief of the Materiel Command, pertains to procurement, manufacture, receipt, storage, issue and maintenance of materiel for which the Chemical Corps is responsible.

Colonel Richardson, a native of Indiana, entered the Army in 1942 as an enlisted man; was commissioned after attending Officer Candidate School, and was integrated into the Regular Army in 1946. In World War II he served in the European Theatre. He has twice been awarded the Commendation Ribbon with Medal Pendant.

H. A. KUHN

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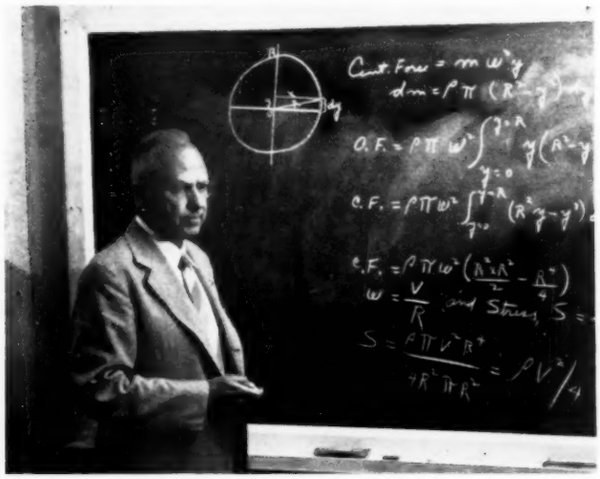
DR. TANNER, SCIENTIST WITH MANY INTERESTS, RETIRES



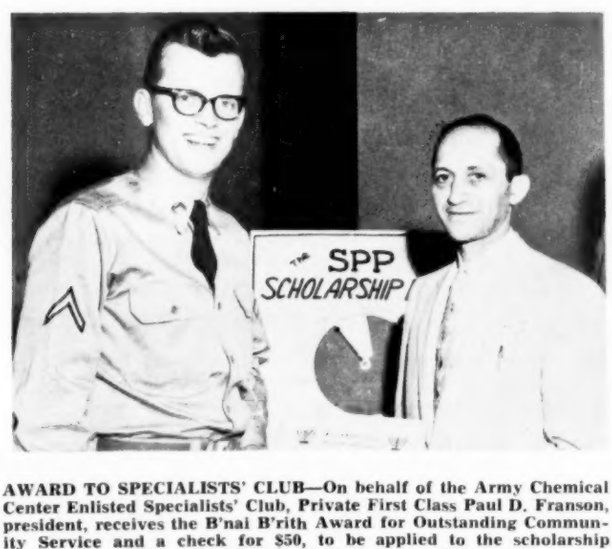
A "scientist's scientist" is the way many of his friends speak of Dr. Herbert G. "Bert" Tanner, who retired on July 31 after 13 years of military and civilian service at Fort Detrick, Md.

Dr. Tanner is a physical chemist but is actively interested in other fields, notably astronomy, biology, archaeology, wildlife, and ornithology.

Dr. Tanner was born on November 30, 1893, in Atchison, Kansas. He attended Ottawa College, Kansas, where he received a bachelor of arts degree in physics in 1915. He took his master's degree at the University of Nebraska and his doctorate at Stanford, having done part of his work for the latter at Cornell.

Dr. Tanner holds six patents and has applications pending for two more. He is author of more than twenty published technical articles. Among the fields in which he has done extensive work is that of activated charcoal.

B'NAI B'RITH AWARD TO ACC ENLISTED SPECIALISTS



AWARD TO SPECIALISTS' CLUB—On behalf of the Army Chemical Center Enlisted Specialists' Club, Private First Class Paul D. Franson, president, receives the B'nai B'rith Award for Outstanding Community Service and a check for $50, to be applied to the scholarship the club is sponsoring. The presentation was made last May by Mr. Sidney Breitbart (right), president of the B'nai B'rith chapter.

COLONEL HALE JOINS FOOD MACHINERY AND CHEM. CORP.

Colonel Donald H. Hale who retired last June while serving as Commander, Chemical Warfare Laboratories at Army Chemical Center, Md., is joining the Central Engineering Department of the Food Machinery and Chemical Corp., at San Jose, California. This information was contained in a recent announcement by Executive Vice-President Ben C. Carter of FMC, in which he stated that Colonel Hale would be associated with the Corporation's expanding program in the study of food irradiation. Colonel Hale, who has a Ph.D. degree in physics and mathematics formerly commanded the Dugway Proving Ground in Utah.

MRS. SCHINDELE RETIRES AFTER 32 YEARS SERVICE

Mrs. Margaret Schindele who served as a Chemical Corps employe for 32 years retired last June. Mrs. Schindele is well known throughout the Corps having held a number of important secretarial assignments at the Army Chemical Center and other offices of the Corps. A true daughter of the Army, Mrs. Schindele has been connected with the military service since the day of her birth, which was at the staff hospital at West Point, New York. Her father, a career soldier and veteran of the Spanish War, was then stationed there. In 1921 her father came to duty at Army Chemical Center, Md. (then Edgewood Arsenal) and three years later Mrs. Schindele enrolled in the Civil Service there.

SEEING ATOMS

(Continued from page 30)

plication of a high field alone. Tungsten, for instance, evaporates at liquid hydrogen temperature at a rate of one monolayer per second when it is exposed to a field of 570 million volts per centimeter. This cold evaporation serves also to perfectly clean the surface without the application of heat, and to measure binding energies of single atoms at various sites on the crystal surface.

The low temperature field ion microscope promises to become a useful tool for basic research on surfaces. For the first time we can take a direct look at the arrangement of atoms in a metal surface. However, the experimentation as well as the interpretation is not very easy in spite of the apparent simplicity of the apparatus. After all, single atoms are delicate to manipulate with and they are extremely small. There are probably fewer grains of sand at all the beaches of the whole New Jersey coast, 30 feet deep into the ground and including all dunes, than there are atoms in the head of a pin.

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2. E. W. Müller, Z. f. Physik **131**, 136 (1951).
3. E. W. Müller, and K. Bahadur, Phys. Rev. **102**, 624 (1956).
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5. E. W. Müller, Phys. Rev. **102**, 618 (1956).

COLONEL GREENE TO HAWAII

Colonel William H. Greene is shown in the above picture bidding goodbye to five officers of his command at Pine Bluff Arsenal, Arkansas, who recently received orders to other stations.

This October Colonel Greene himself received a new assignment to the Joint Army-Navy-Air Force Staff of the Pacific Area Commander with station at Pearl Harbor, Honolulu, T.H.

Colonel Russell W. Dodds, currently the Inspector General of the Chemical Corps, succeeds Colonel Greene.

The officers in the picture and their new assignments are (L to R): 1st Lt. Charles Kirkham, Training Command, Fort McClellan, Alabama; Major R. W. Lane, Advanced Course, Chemical Corps School; Colonel Greene, Hawaii; Lt. Col. Michael R. De Carlo, U. S. Embassy, Ottawa, Canada; Major F. O. Wells, Command and General Staff College; and 1st Lt. Paul O. McCoy, leaving the service to attend the University of Oklahoma for a master's degree.

DR. TERVET, NATIVE OF SCOTLAND, IS GIVEN NEW POST AT DUGWAY

Dr. Ian Tervet, former university professor and U. S. Government research scientist in plant pathology, has been named Deputy for Scientific Activities at the Army Chemical Corps testing center, Dugway Proving Ground, Utah.

Dr. Tervet who has been at Dugway since 1951, was previously employed at the Chemical Corps installation, Fort Detrick, Md. He was born in Glasgow, Scotland in 1907, was graduated from the University of Glasgow in 1931 and came to the United States on a Commonwealth Fund Fellowship. He attended the University of Minnesota where he received his doctor's degree in Plant Pathology.

Dr. Tervet has taught at the University of Glasgow, the University of Minnesota and the University of Nebraska.

U. S. Army Photo

SIX NATIONS REPRESENTED IN CHEMICAL SCHOOL CLASS

FORT McCLELLAN, Ala.—Fifteen allied officers, representing six nations, make up the newly established First Allied Chemical Officer Basic Course at the Chemical Corps School, Fort McClellan. The 12-week course, planned exclusively for allied officers, is similar to the Chemical Officer Basic Course offered at the School. Left to right are (front row): Maj. Cemal Ertung (Turkey); Lt. Col. Ui K. Whang (Korea); Lt. Col. Konstandinos Theodorou (Greece), Class Commander; Col. Carl V. Burke, Chemical Corps School Commandant; Col. Cecil H. Wood, Assistant Commandant; Maj. Morris Lofton, Class Director; and Lt. Col. Han Q. Bay (Denmark). Middle row: Lt. Zekai Tuzun (Turkey); Capt. Shohei Tatebayashi (Japan); Lt. Josef Aninger (West Germany); Lt. Jae O. Choi (Korea); Lt. Remzi Sayin (Turkey); and Capt. Hong T. Choi (Korea). Back row: Lts. Klaus E. Vollmer and Gerhard Elser (West Germany); Lts. Anders Jungersen and Albinus Jorgensen (Denmark); and Maj. Norihiko Kudo (Japan).

GERMAN OFFICERS TRAIN AT VII CORPS CML SCHOOL

In picture above Col. Walter W. Kuehler, VII Corps Chemical Officer and Commandant of the Corps' CBR Instructors' School in Germany, is presenting a diploma to Lt. Col. Herbert Mitzscherling. Colonel Mitzscherling was one of 14 German Army officers who attended a recent 5-day course of instruction conducted by Colonel Kuehler and his staff for chemical personnel of the VII Corps. Observing the presentation is Lt. Col. Horst Kormorowski of the German Federal Ministry of Defense. (This information is contained in the 14 September issue of *The Jayhawk*, the VII Corps' weekly newspaper, copy of which was recently sent to the JOURNAL.)

BODY ARMOR

(Continued from page 34)

wounds in these regions. Also, the confidence and fighting spirit of the soldiers was markedly improved upon wearing the vest. Many instances were reported where men fell on grenades, resulting in their vest being almost completely destroyed without their sustaining a wound. Numerous lives saved and wounds prevented were recorded by the wound ballistics teams operating in Korea.

During the course of the Korean conflict, the Medical Research and Development Board, Office of the Surgeon General, organized and dispatched seven wound ballistics and body armor missions in Korea. The Biophysics Division of the Chemical Corps Medical Laboratories furnished representatives for these missions. Field studies such as these yield important information unobtainable in the laboratory.

Because of advances in vascular surgery, time saved by helicopter evacuation, and the accessibility of the Mobile Army Surgical Hospital to the front lines, the percentage of deaths after admission to a medical treatment facility had been reduced to 2.5%. It was concluded that if further reduction in number of deaths was to be obtained, this reduction would have to occur among the number killed in action on the battlefield. Since surgical procedures are impossible on the field of battle, the armored vest could be the new form of preventive medicine needed to reduce the number of killed in action.

Upon arrival back in the United States a nylon vest was designed by members of these teams in cooperation with the Research and Development Division, Office of the Quartermaster General, Army. Members of these teams included personnel from the Quartermaster Corps, Medical Services, Ordnance Department, Field Forces, and Chemical Corps. This vest incorporated many of the design features suggested by the combat soldiers in Korea. After further modifications the nylon vest was standardized by the Quartermaster Corps as an item of issue for all front line combat personnel.

It is from this kind of information, which gives important data on just what kind of battlefield hazard the soldier faces, that design bases for body armor can be established. It permits, for example, assignment of priorities of coverage to various body regions. Thus, the permitted amount and weight of armor material can be distributed among the various body regions, so that the area needing most protection—i.e., affording the greatest chance of saving a life—can be given most consideration in design.

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CONGRESSIONAL MEDAL OF HONOR SOCIETY

The Congressional Medal of Honor Society of the United States plans to hold its first National Convention at Lakeland, Florida, during the period 9-14 November, 1956. Lieutenant General Leon W. Johnson, U.S. Air Force, U.S. Representative to NATO and brother of Mr. Oliver F. Johnson, a vice-president of Armed Forces Chemical Association, is President of the Society.

It is estimated that of the approximately 350 living Congressional Medal of Honor winners, about 150 will attend the meeting. Inquiries concerning it should be sent to Mr. Richard W. O'Neill, Executive Director, 36 West 44th Street, New York 36, New York.

DUGWAY

(Continued from page 9)

social, professional and community activities that thrive on the post. To name a few: the "Skull Valley Players" is an amateur theatrical group which produces some five plays a year—the best Broadway dramas are offered and very capably; the Scouting movement encompasses Boys, Girls, Cubs, Brownies and Explorers and is very active—they have received consistently high rating in the state; the Granite Peak Masonic Club; the American Legion; the American Association of University Women; the PTA; the Photography Club, and those individuals who venture forth in quest of minerals, geodes and stones which abound in the area—the "Rockhounds"—these are but a small portion of the many worthwhile activities that flourish at the installation.

And, for those who prefer travel, very little needs to be said about the natural and scenic wonders that are so plentiful in the Intermountain West—Yellowstone, the Grand Canyon, Bryce and Zion National Parks.

In a word, Dugway offers a life that has proven professionally appealing as well as materially gratifying.

A.F.C.A. TO REPEAT $1,000 SCIENCE TEACHER AWARD

The Board of Directors of A.F.C.A. at their semi-annual meeting held at the Cosmos Club in Washington, D.C. Oct. 22, 1956, voted unanimously to repeat this coming year the $1,000 award by the Association to an outstanding science or mathematics teacher at the high school level. President Hutt requested that the Science Teacher Award Committee which had charge of last year's contest act in that capacity again for the 1957 award. This Committee, which consists of Dr. Ralph E. Gibson, Lt. Col Ovid E. Roberts, Jr., and Mr. Paul Bauman, has decided that the same rules which governed the 1955-56 contest will apply for 1956-57.

NUCLEAR REACTOR PROJECT FOR INDUSTRIAL RESEARCH

NEW YORK, Sept. 25—Ten of America's large corporations have formed a new company, Industrial Reactor Laboratories, Inc., to build and operate a privately owned nuclear reactor for industrial research in atomic energy, at Plainsboro, N.J.

The companies participating are Atlas Powder Co., AMF Atomics, Inc. (subsidiary American Machine & Foundry Co.), American Tobacco Co., Continental Can Co., Corning Glass Works, National Distillers Products Corp., National Lead Co., Radio Corporation of America, Socony Mobil Oil Co., and United States Rubber Co. Each participant is represented on the company's board of directors, which will be headed by General Walter Bedell Smith, President, and H. L. Hilyard, Vice-President. General Smith is Chairman and President of AMF Atomics Inc. Mr. Hilyard is Treasurer of the American Tobacco Co.

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—U.S. Air Force photo

JANUARY-FEBRUARY 1957

IN THIS ISSUE: "Setting the Sights for Industry," the theme for A.F.C.A.'s 1957 annual meeting, Washington, D.C., May 22-23-24, with Air Force as Service Host.

BODY ARMOR

(Continued from page 34)

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